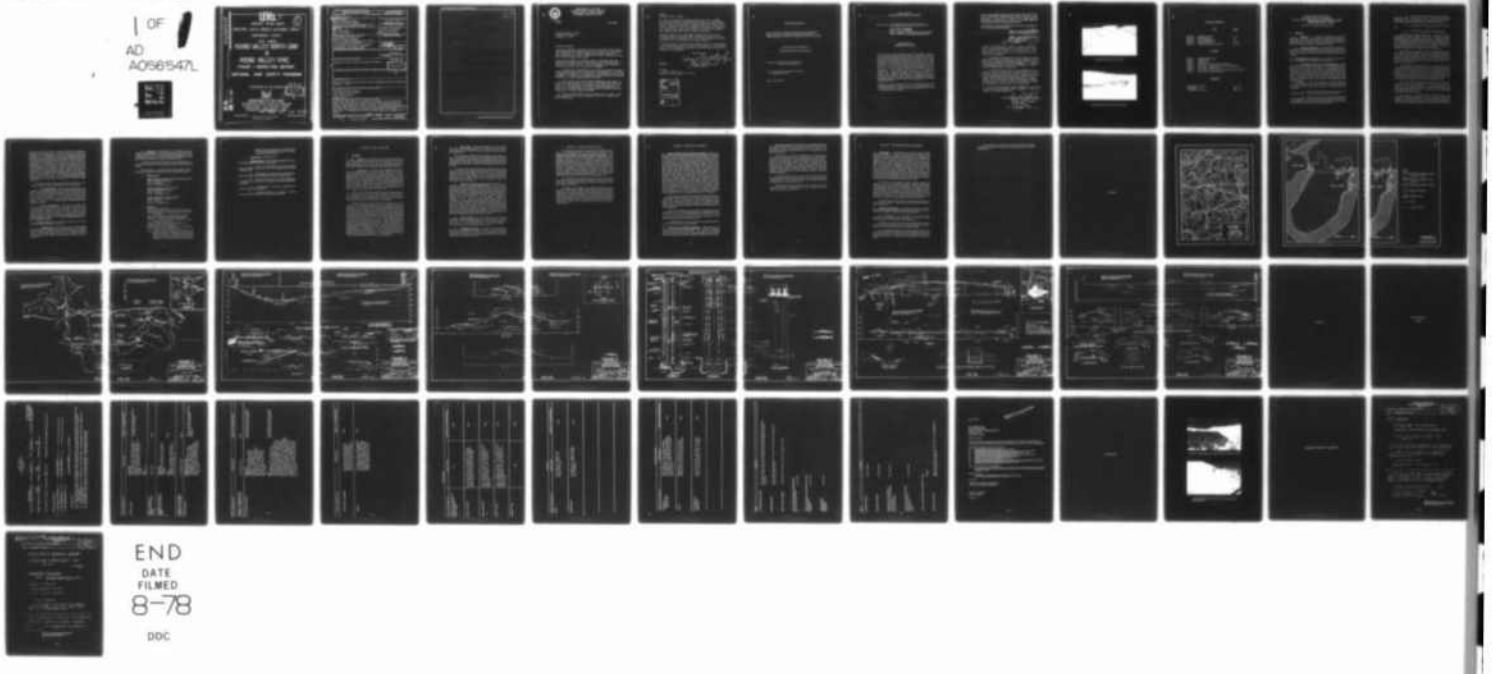
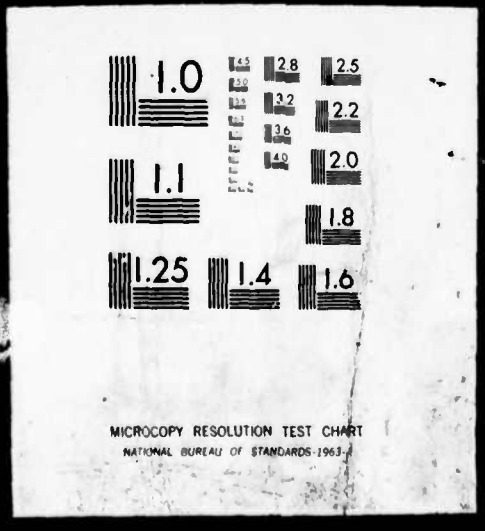
AD-A056 547 O'BRIEN AND GERE ENGINEERS INC PHILADELPHIA PA JUSTIN--ETC F/G 13/2
PHASE I INSPECTION REPORT. NATIONAL DAM SAFETY PROGRAM, ROUND V--ETC(U)
MAY 78 J J WILLIAMS DACW61-78-C-0052

UNCLASSIFIED NL

1 OF 1
AD
A056547L



END
DATE FILMED
8-78
DDC



LEVEL II

(1)

RARITAN RIVER BASIN

TRIBUTARY SOUTH BRANCH ROCKAWAY CREEK,

HUNTERDON COUNTY

NEW JERSEY

ROUND VALLEY NORTH DAM
&
ROUND VALLEY DYKE

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

NJ 00013 & NJ 00022

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE - 2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

MAY 1978

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER: NJ00013 & NJ00022
2. GOVT ACCESSION NO.
3. RECIPIENT'S CATALOG NUMBER

4. TITLE (and Subtitle): Phase I Inspection Report. National Dam Safety Program, Round Valley North Dam, Round Valley Dyke, Hunterdon County, New Jersey.

5. TYPE OF REPORT & PERIOD COVERED: FINAL rept.,

6. PERFORMING ORG. REPORT NUMBER

7. AUTHOR(s): John J. Williams, P.E.

8. CONTRACT OR GRANT NUMBER(s): DACW61-78-C-0052

9. PERFORMING ORGANIZATION NAME AND ADDRESS: O'Brien & Gere Engineers, Inc., Justin & Courtney Division, 1617 J.F. Kennedy Blvd., Phila., PA, 19103

10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS

11. CONTROLLING OFFICE NAME AND ADDRESS: U.S. Army Engineer District, Philadelphia, Custom House, 2d & Chestnut Streets, Philadelphia, Pennsylvania 19106

12. REPORT DATE: MAY 78

13. NUMBER OF PAGES: 45 (54p.)

14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)

15. SECURITY CLASS. (of this report): Unclassified

15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia, 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

National Dam Safety Program
Dam Inspection Report Phase I
Round Valley North Dam
Round Valley Dyke, NJ
Dams - N.J.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-D

3 JUL 1978

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, NJ 08621

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Round Valley North Dam and Round Valley Dyke in Hunterdon County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition and the dyke's condition is given on the first two pages of the report.

Based on visual inspection, available records, calculations and past operational performance, Round Valley North Dam and Round Valley Dyke are judged to be in fair condition. To insure adequacy of the structures, the following actions, as a minimum, are recommended:

a. Installation of piezometers on both structures should be initiated within one month from the date of approval of this report and a new stability analysis performed if the readings differ significantly from the design assumptions. In addition, the embankments should be monitored continuously for signs of increased seepage and/or turbid water.

b. Within three months from the date of approval of this report, the cracks in the paving on the crest of Round Valley North Dam should be excavated in several locations to determine if they extend below the macadam surface. Alternatively, an acoustic emission monitoring system together with a marking system, such as paint marks at selected cracks and extension of the cracks, could be provided.

c. Within one year from the date of approval of this report, the upstream slope protection should be repaired to provide a suitable well graded riprap layer.

NAPEN-D
Honorable Brendan T. Byrne

Two copies of the report are being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congresswoman Helen S. Meyner of the Thirteenth District. Under the provisions of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, thirty days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia, 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Safety Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely yours,

Harry V. Dutchyshyn

HARRY V. DUTCHYSHYN
Colonel, Corps of Engineers
District Engineer

1 Incl
As stated

Cy Furn:
Mr. Dirk C. Hofman, P.E.
Department of Environmental Protection

RARITAN RIVER BASIN

Name of Dam: Round Valley North Dam and Round Valley Dike
County and State: Hunterdon County, State of New Jersey
Inventory Numbers: North Dam - NJ 00013; North Dike - NJ 00022

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Prepared by: O'Brien & Gere Engineers, Inc.
Justin & Courtney Division

For: United States Army Corps of Engineers
Philadelphia District

Date: May 24, 1978

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam Round Valley North Dam and Round Valley Dike

State Located New Jersey
County Located Hunterdon
Stream Tributary to South Branch Rockaway Creek
Dates of Inspection April 19 and April 24, 1978

ASSESSMENT OF GENERAL CONDITIONS

The Round Valley North Dam and Dike appear to be stable. However, areas of surface wetness, standing water, and seepage were observed on the downstream slopes of both structures and were most evident along the berms and lower third of the downstream slopes. These observations indicate that the phreatic line, for both the North Dam and Dike, may intersect the downstream slope above the filter blanket or rock toe. A swamp area immediately downstream of the Dike toe is an indication that seepage may be coming from the rock foundation or active springs in addition to the flow from the embankment. Piezometers should immediately be installed to monitor pore pressures throughout both embankments, and the resulting data evaluated and compared with design assumptions to determine the need for further analysis of embankment stability. Provisions should be made for regular measurement of flow from the embankment drains.

Inspection of the rock riprap used for the upstream slope protection of both embankments revealed signs of rock size segregation and material deterioration. The riprap should be supplemented to provide a well graded, protective layer.

Vertical cracks, observed along the crest of the North Dam, may be due to temperature changes, and/or lateral movement in the embankment. The area in the vicinity of the cracks should be excavated in several locations to determine if the cracks extend into the embankment material beneath the macadam.

The appurtenant structures associated with the North Dam appear to be sound, and are well maintained.

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

John J. Williams, P.E.
Vice President

Based on visual inspection, abailable records, calculations and past operational performance, Round Valley North Dam and Round Valley Dyke are judged to be in fair condition. To insure adequacy of the structures, the following actions, as a minimum, are recommended:

a. Installation of piezometers on both structures should be initiated within one month from the date of approval of this report and a new stability analysis performed if the readings differ significantly from the design assumptions. In addition, the embankments should be monitored continuously for signs of increased seepage and/or turbid water.

b. Within three months from the date of approval of this report the cracks in the paving on the crest of Round Valley North Dam should be excavated in several locations to determine if they extend below the macadam surface. Alternatively, an acoustic emission monitoring system together with a marking system, such as paint marks at selected cracks and locations, and measurements to provide a means of observing any enlargement and extension of the cracks, could be provided.

c. Within one year from the date of approval of this report, the upstream slope protection should be repaired to provide a suitable well graded riprap layer.

APPROVED: Harry N. Dutchyshyn
HARRY N. DUTCHYSHYN
Colonel, Corps of Engineers
District Engineer

DATE: 3 July 1978

DOWNSTREAM SLOPE OF DIKE

DOWNSTREAM SLOPE OF NORTH DAM

TABLE OF CONTENTS

FIGURES

APPENDIX

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
NAME OF DAMS ROUND VALLEY NORTH DAM ID# 00013
ROUND VALLEY DIKE ID# 00022

SECTION I - PROJECT INFORMATION

1.1 GENERAL

a. Authority - This report is authorized by the Dam Inspection Act, Public Law 92-367, and has been prepared in accordance with contract #DACW61-78-C-0052 between O'Brien & Gere Engineers, Inc., Justin & Courtney Division, and the United States Army Corps of Engineers, Philadelphia District.

b. Purpose of Inspection - The purpose of this inspection is to evaluate the structural and hydraulic conditions of Round Valley North Dam, Round Valley Dike, and appurtenant structures, and to determine if the Dam or Dike constitutes a hazard to human life or property.

1.2 DESCRIPTION OF PROJECT (from information supplied by New Jersey Department of Environmental Protection)

a. Description of Dam, Dike, and Appurtenances - Round Valley reservoir is located in the foothills of Hunterdon County, about one mile south of Lebanon, New Jersey. The impoundment area was formed by the construction of two dams (North and South) and a dike. The North Dam is constructed across a tributary of the South Branch of Rockaway Creek, which drains to the North Branch of the Raritan River. The Dike, which is about one-half mile west of the North Dam, is constructed across a swale which drains toward the South Branch of Rockaway Creek. The South Dam is constructed across Prescott Brook.

According to the design drawings, by Porter, Urquhart, McCreary & O'Brien, Round Valley North Dam and Round Valley Dike are rolled earth embankments which consist of the following types of materials:

1) Zone 1 Impervious Fill forms the core of the embankments and the backfill of the impervious core trenches.

2) Zone 2 Fill forms a portion of the outer shells of the embankments. Specified compaction requirements are similar to those required for Zone I, but the specified gradation requirements are suitable to a more pervious material than Zone I.

3) Zone 3 Random Fill forms the remainder of the embankment shell of the North Dam. Specified compaction requirements vary depending on the degree of earth or rock fragments contained in the excavation from the borrow areas.

4) Downstream filter blanket and slope protection filter.

5) Rock toe and dumped rock slope protection.

The Dam has a maximum height of about 134 feet and is approximately 1,460 feet long. The top width of the Dam is 30 feet, and consists of an 11foot wide bituminous surfaced roadway with 9.5-foot wide, grass covered shoulders on each side. The upstream slope is 3:1 (horizontal:vertical); the downstream slope is 2.5:1 and is provided with three gutter berms and a wide, Random Fill toe berm sloped at approximately 5 percent (20:1). Refer to Figure 5 for details concerning transverse sections of the embankment.

The Dike has a maximum height of about 78 feet and is approximately 2,335 feet long. The top width is 40 feet, and consists of a 22-foot wide macadam roadway with 6-foot wide macadam shoulders and grassed berms on each side. The upstream slope of the Dike is 3:1 (horizontal:vertical); the downstream slope is 2.5:1 and is provided with a gutter berm and a toe ditch. Refer to Figure 8 for details of Dike sections.

A rectangular concrete Outlet Tower (35 feet by 29 feet) is located at the upstream toe of the North Dam. The tower houses two outlet shafts with sluice gates located at three levels for water quality control. Seventy-two (72) inch diameter conduits, located at the base of each outlet shaft, are used for water releases. The conduits are steel encased in concrete, extending about 1,000 feet from the Outlet Tower to a rectangular concrete valve vault. The vault is located just downstream of the Random Fill toe berm.

The Dam, Dike and Appurtenant Structures are owned and operated by the New Jersey Department of Environmental Protection, Division of Water Resources. The primary purpose of the structures is impoundment of water to supplement the water supply for north central New Jersey. The reservoir area has also been developed as a recreational area.

The structures for Round Valley Reservoir project were designed by Porter, Urquhart, McCreary, & O'Brien, Consulting Engineers, of Newark, New Jersey. The construction application was submitted to the State of New Jersey Department of Conservation, Division of Water Policy and Supply, on March 1, 1961, and approval

was granted on May 31, 1961. On March 30, 1961 the construction contract for the North Dam, the South Dam, and the Dike was awarded to C.J. Langenfelder & Son, Inc., of Baltimore, Maryland. Information on the construction of the North Dam and Dike included extensive commentary concerning the inability of the contractor to meet specified compaction criteria during the initial stages of construction. The specifications required that "each layer of the embankment shall be compacted ... to secure a dry density of not less than 95 percent of the maximum dry density as determined by the AASHO Method T99 as modified herein, for Zone 1 and Zone 2." Compaction tests generally gave results ranging from 88 to 95 percent of the modified AASHO requirements. The embankment compaction was observed by Mr. Thomas Fluhr, Engineering Geologist with the State of New Jersey. In a Progress Memorandum dated October 26, 1961, he stated that the embankment "is being thoroughly compacted."

The original stone rubble gutter berms were found to be unacceptable and in 1970 were replaced with concrete gutters.

b. Size Classification - The Round Valley Reservoir was designed for a storage volume of 55 billion gallons (168,000 acre-feet) at the maximum operating pool elevation of 385 feet mean sea level (MSL). The maximum heights of the North Dam and the Dike are 134 feet and 78 feet respectively. Since the normal storage volume exceeds 50,000 acre-feet, the dam and dike are in the large size category as defined by the Recommended Guidelines for Safety Inspection of Dams.

c. Hazard Classification - The Town of Lebanon, New Jersey is located within a mile of both the North Dam and the Dike. The topography downstream of both structures is such that flow would be directed towards the Town of Lebanon. A failure of either the North Dam or Dike could result in the loss of many lives and extensive economic losses. Therefore, both structures are in the high hazard category as defined by the Recommended Guidelines for Safety Inspection of Dams.

1.3 PERTINENT DATA (from information supplied by New Jersey Department of Environmental Protection)

a. Drainage Area - The drainage area of the Round Valley Reservoir is about 5.4 square miles, as determined by use of United States Geological Survey quadrangle sheets (7.5 minute), for Flemington, New Jersey, and Califon, New Jersey. The surface area of the reservoir at maximum operating pool (Elevation 385.0) is about 3.6 square miles.

b. Discharges - Discharge from the reservoir is accomplished through operation of sluice gates located in the North Dam Outlet Tower. Each of the two outlet shafts is equipped with three rectangular sluice gates: a 3-foot by 5-foot gate at Elevation 357.0, and 5-foot by 6-foot gates at Elevations 307.0 and 270.0.

A statutory conservation discharge of 0.17 million gallons per day must be maintained to the tributary to South Branch Rockaway Creek.

Round Valley is a pumped-storage water supply reservoir; therefore, construction of a spillway was not considered necessary.

c. Reservoir Data

Maximum Operating Pool (Reservoir at Elevation 385.0)
Length - 8,000 feet (maximum)
Area - 2,300 acres
Volume - 168,000 acre-feet

Top of Dam and Dike (Elevation 395.5)
Length - 8,000 feet (maximum
Area - 2,400 acres
Volume - 193,000 acre-feet

Maximum Pool (PMF - Elevation 388.0)
Length - 8,000 feet (maximum)
Area - 2,300 acres
Volume - 175,000 acre-feet

d. Dam Data
Type - earth embankment
Top elevation - 395.5 feet (North Dam), 395.65 (Dike)
Streambed elevation at centerline of dam - 262.0 feet (North Dam)
Length - 1,460 feet (North Dam), 2,335 feet (Dike)
Top width - 30 feet (North Dam), 39 feet (Dike)
Side slopes - upstream slope 3:1 (horizontal to vertical); downstream slope 2.5:1
Zoning - three zones as explained in Section 1.2.a
Impervious core - Zone 1 material
Cutoff - 4-foot thick concrete cutoff from the bottom of the core trench to sound rock.
Grout Curtain - Grouting of the rock foundation was specified along the centerline axis of both the North Dam and Dike. Specified grout holes were spaced at 10-foot centers along each axis and staggered 1.5 feet about the axis. The specified

depth of zoned grouting varied from 10 feet to 50 feet across the North Dam, and from 30 feet to 150 feet across the Dike.

e. Outlet Works - See Section 1.3.b.

f. Engineering Data - The information available for review of Round Valley North Dam and Dike included:

1) A set of 52 drawings for the Round Valley Reservoir Project, North Dam, Dike, and Appurtenant Structures (Contract RV-2).

2) Special Report 15, State of New Jersey, Department of Conservation and Economic Development, August 1958.

3) Contract RV-2, State of New Jersey Department of Conservation and Economic Development, Division of Water Policy and Supply.

4) Correspondence, Construction Inspection Reports, and Miscellaneous Reports.

5) Documents supplied by the Bureau of Water Facility Operations, Clinton, New Jersey (see page A10).

SECTION 2 - VISUAL INSPECTION

2.1 FINDINGS

a. General - The field inspection of the embankments of the North Dam and Dike took place on April 24, 1978. The outlet works associated with the North Dam were inspected on April 19, 1978. The reservoir water surface elevation was about 381 feet MSL during both inspection visits. No underwater areas were inspected.

b. North Dam - The riprap on the upstream face of the dam is a poorly graded mix of large angular rocks (2 to 4 feet in diameter) and small rocks (6 inches or less in diameter). There is little uniformity in the distribution and placement of the rocks. The upper portion of the embankment appears to differ from the design drawings. The drawings indicate a 3:1 slope for the upstream face with no benches. The visible portion of the upstream face appeared to have a steeper slope (about 2:1) and a 10 to 15-foot bench just below the water surface. Some driftwood was noted within 2 to 3 feet of the top of the dam. On the east side of the embankment is an area of about 25 square feet that is free of riprap.

Small vertical cracks were observed in the macadam roadway on the top of the dam. The cracks are parallel to the crest of the dam, and appear to be continuous from the Outlet Tower Bridge to about 200 feet from the east abutment. Settlement up to 12 inches was observed in an area on the roadway near the bridge.

Standing water was noted at several locations, above the top berm, on the downstream slope of the dam. The wet spots were located where it was reported that grass mowing equipment had left impressions in the slope. An area of local settlement was observed above the top berm opposite the Outlet Tower. This area may be over the alignment of the twin 72 inch pipes that are constructed under the dam. On the downstream slope, and area of standing water was observed just above the middle (second) berm, approximately 200 feet from the west abutment. The area is at least 200 feet long and extends above the berm for about 30 feet. There was also evidence of water flowing out of the embankment about 3 feet above the middle berm, approximately 100 feet from the east abutment. A broad undulating depression was observed along the west abutment drainage gutter. It extended from the bottom (third) berm to the middle berm, and is about 100 feet wide. A number of springs were observed along the east abutment. Discharge from the springs has been directed into the drainage ditch. A discharge in excess of 1 cfs from the filter blanket drain and rock toe was observed.

c. North Dike - The riprap protection on the upstream face of the Dike is very similar to the riprap on the North Dam. Small trees that had started growing on the upstream slope have been cut at rock level.

The central 300 to 400 feet of the downstream slope below the berm was generally very moist with a significant growth of reeds. The area immediately downstream from the embankment was marshy and overgrown with reeds. A local settlement area was observed on the downstream slope near the center of the embankment just above the toe.

Three drop inlets were observed: one at each abutment along the toe, and one at the center of the embankment berm. Runoff and seepage is directed from each of the drop inlets to a common basin near the center of the embankment toe. A corrugated metal pipe extends from the central basin to the marshy area located just downstream from the toe. At the time of inspection, water was flowing into each of the inlets.

d. Outlet Tower and Appurtenances (See Figure 6) - The condition of the Outlet Tower and bridge appeared to be excellent. The gates could not be operated during the inspection, but Mr. Chase, Supervising Engineer at the Bureau of Water Facilities Operations, in Clinton, New Jersey, stated that no problems have been encountered during gate operation. The assemblies and motors showed no external signs of wear or deterioration. A mobile gasoline operator is available for use, in case of an electrical failure. Stoplogs are available for use. The valve vault located about 1,000 feet downstream of the embankment also appeared in good condition. The inspection team walked the 72 inch diameter discharge pipes to the base of the Outlet Tower. The 72 inch lines are normally pressurized only during testing at the release works. At the base of the Outlet Tower, an insignificant amount of seepage was noted through the tower wall, as well as minor honeycombing of the concrete. The pipes are coated with coal tar epoxy enamel. At the joints, some rust had broken through the coating, but it is not serious.

e. Reservoir Area - The natural valley walls surrounding the reservoir have moderate slopes and are well covered with trees and brush. A dike has been constructed across a narrow portion of the reservoir in the north-west corner. The dike separates a swimming area from the main body of the reservoir.

f. Downstream Channel - A tributary to South Branch Rockaway Creek originates at the North Dam. A railroad spans the channel about 2,000 feet downstream of the embankment. Drainage downstream of the North Dike is directed toward a minor tributary of the South Branch Rockaway Creek.

SECTION 3 - HYDROLOGY/HYDRAULICS

The design flood used for the Round Valley Reservoir structures is the Probable Maximum Flood (PMF), according to the Recommended Guidelines for Safety Inspection of Dams. The reservoir surface at the maximum operating level (Elevation 385.0), comprises about two-thirds of the drainage area. Spillways were not considered necessary in any of the project structures, since the freeboard included allowance for storage of the PMF. The PMF was derived from the adjusted 48 hour Probable Maximum Precipitation (PMP). The volume of rainfall (PMP) that falls on the land portion of the basin was added to storage after adjustment for losses. The volume of rainfall (PMP) that falls on the reservoir portion of the basin was added to storage assuming no losses. The 48 hour PMP would raise the reservoir water surface about 3 feet. The minimum allowable freeboard at maximum pool is estimated at 4.4 feet.

The embankments are provided with 10.5 feet of freeboard above the maximum operating pool. Therefore, no difficulty is to be anticipated in adequately storing the rainfall excess of a storm less than or equal to the PMP.

According to Mr. Chase, water releases are restricted to a maximum of 600 million gallons per day (mgd) through the release works on the North Branch Rockaway Creek, and 20 mgd through a bypass line in the pump station on the Raritan River. Mr. Chase added that the maximum discharge into Rockaway Creek could cause severe downstream erosion. Therefore, the reservoir can be drawn down about one foot per day. If a large drawdown were immediately necessary, the pumps at the Raritan River pump station would have to be removed.

SECTION 4 - STRUCTURAL STABILITY

4.1 VISUAL OBSERVATIONS AND DATA REVIEW - Design analyses for both the North Dam and the Dike were provided by personnel of the New Jersey Department of Environmental Protection, Division of Water Resources, Bureau of Water Facility Operation, Clinton, New Jersey. Flow net and stability analyses were performed by the design engineering firm (Porter, Urguhart, McCreary & O'Brien) for maximum operating pool condition (Elevation 385.0) and for rapid drawdown from Elevation 385.0 to Elevation 300.0. Sliding circles with various radii were analyzed for both the upstream and the downstream slopes, with the downstream slope analyzed for permeability ratios (K_h/K_v) of 2.25 and 9.0. Determination of the most critical circle was made by assuming friction angles of 15, 20, and 25 degrees for circle groups of various radii. Cohesion values necessary to give a constant factor of safety were computed using an abbreviated method of slices for the stability analyses. For a given friction angle, the maximum required cohesion value indicated the radius of the most critical circle. The conventional method of slices was then applied to the critical circle. For the downstream slope, factors of safety were computed as 1.33 for the North Dam and 1.93 for the Dike, with the ratio of horizontal to vertical permeability (K_h/K_v) assumed to be 9. For the upstream slope, factors of safety were computed as 1.11 for the North Dam, and 1.71 for the Dike.

The flow nets for the North Dam and Dike were constructed by a graphical method, assuming a homogenous embankment and the filter blanket drains to be operable. The design discharge for the drain in each embankment was three times the computed seepage (.0015 cfs or .7 gallons per minute). During the inspection, the flow from the drains of both the North Dam and Dike was in excess of the design discharge.

The design calculations for the Outlet Tower appeared to be satisfactory. The structural loadings used in the design of the tower were for the reservoir at Elevation 300.0 and a wind velocity of 70 miles per hour, and for the maximum ultimate water level of 410.0 feet based on future expansion (See Figure 4).

A comprehensive review of the structural design calculations was beyond the scope of this investigation.

4.2 GEOLOGY AND SEISMIC STABILITY - Both structures are located in the Piemont physiographic province, a lowland containing gently rounded hills and wide valleys. The reservoir is essentially formed by Cushetunk Mountain, a horseshoe shaped Triassic diabase intrusion bounded on the west by Triassic, Paleozoic and older rocks.

North Dam lies across a tributary of South Branch Rockaway Creek which follows along a zone of highly fractured, sheared rock in the diabase structure. The foundation of the dam is entirely within the blocky and fractured diabase complex and was thoroughly grouted during construction.

The Dike area is located in a saddle area on a minor tributary of the same creek, noted above, and is underlain by several geologic units along its entire length. Pre-Cambrian gneiss forms the west abutment, and Hardyston quartzite (Cambrian), Triassic Brunswick shale, and Triassic diabase form the valley foundation and right abutment zones. Faulting is the probable mechanism which causes these complex foundation conditions, and the existence of a fault was indicated from borings made during design and shown in geologic profiles in design reports. Extensive foundation treatment was made during construction.

Although several faults are known to exist in the area, and probably beneath the Dam and Dike, they are considered to be very old and inactive. Their occurence should pose no problem regarding the stability of the North Dam or Dike.

Both structures are located within Seismic Risk Zone 1 of the Seismic Zone Map of Contiguous States, and it appears that static stability conditions are satisfactory.

SECTION 5 - ASSESSMENT/REMEDIAL MEASURES

5.1 ASSESSMENT - The embankments of the North Dam and Dike appear to be stable. However, the moisture and wetness of the downstream slopes and seepage associated with the embankments, indicate that the phreatic line may be intersecting the embankment slopes at a point well above the filter blanket or rock toe. It is possible that the rainfall, which occurred previous to the inspection, may have been partially responsible for this condition at the North Dam. The existence of a significant growth of reeds would indicate that the rainfall was not the principal controlling factor for the moist or wet conditions on the downstream slope of the Dike. The existence of a considerable swamp area immediately downstream of the Dike indicates that seepage may be occurring from the foundation rock beneath the embankment, or from active springs in the area. A review of available information shows no evidence of design consideration relating to the drainage of this downstream area.

The riprap on the upstream slopes is poorly graded and inadequate to provide the necessary protection against wave erosion. The rock appears to have been susceptible to stress release or frost-wedging against fracture planes. According to Mr. Chase, considerable deterioration of the rock has occurred since its placement at the time of construction. Subsequent wave action has left portions of the embankment unprotected. The vertical cracks along the crest of the North Dam could be simply a sign of temperature change or could indicate a more serious condition relating to lateral movement.

The appurtenances associated with the North Dam appear to be in excellent condition, and should not adversely affect the safety of the embankment.

5.2 REMEDIAL MEASURES - The slope protection for both the North Dam and Dike should be supplemented with large and medium sized rocks to provide a suitable well graded riprap layer.

The embankments of both the North Dam and Dike should immediately be equipped with piezometers to monitor the pore pressure development throughout the embankments.

The area in the vicinity of the vertical cracks along the crest of the North Dam should be excavated in several locations in order to observe if the cracks extend below the macadam surface.

If pore pressures shown by the piezometers differ significantly from those assumed in the design flow nets and stability studies, new embankment stability analyses should be performed using pore pressure distributions (or revised flow nets) based on the piezometer data.

The embankments of both the North Dam and Dike should be monitored continuously for signs of increased seepage rates and/or turbid water.

FIGURES

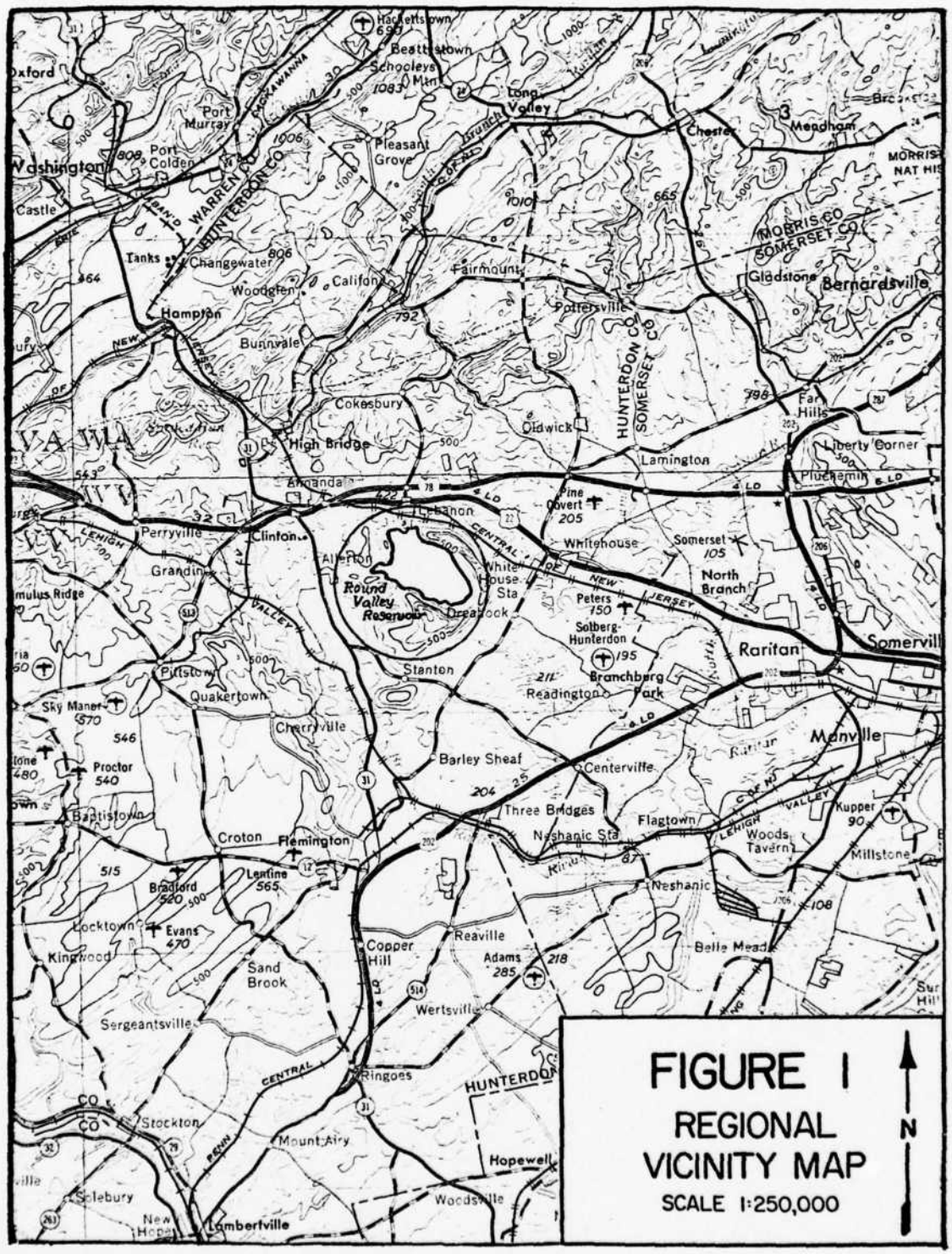
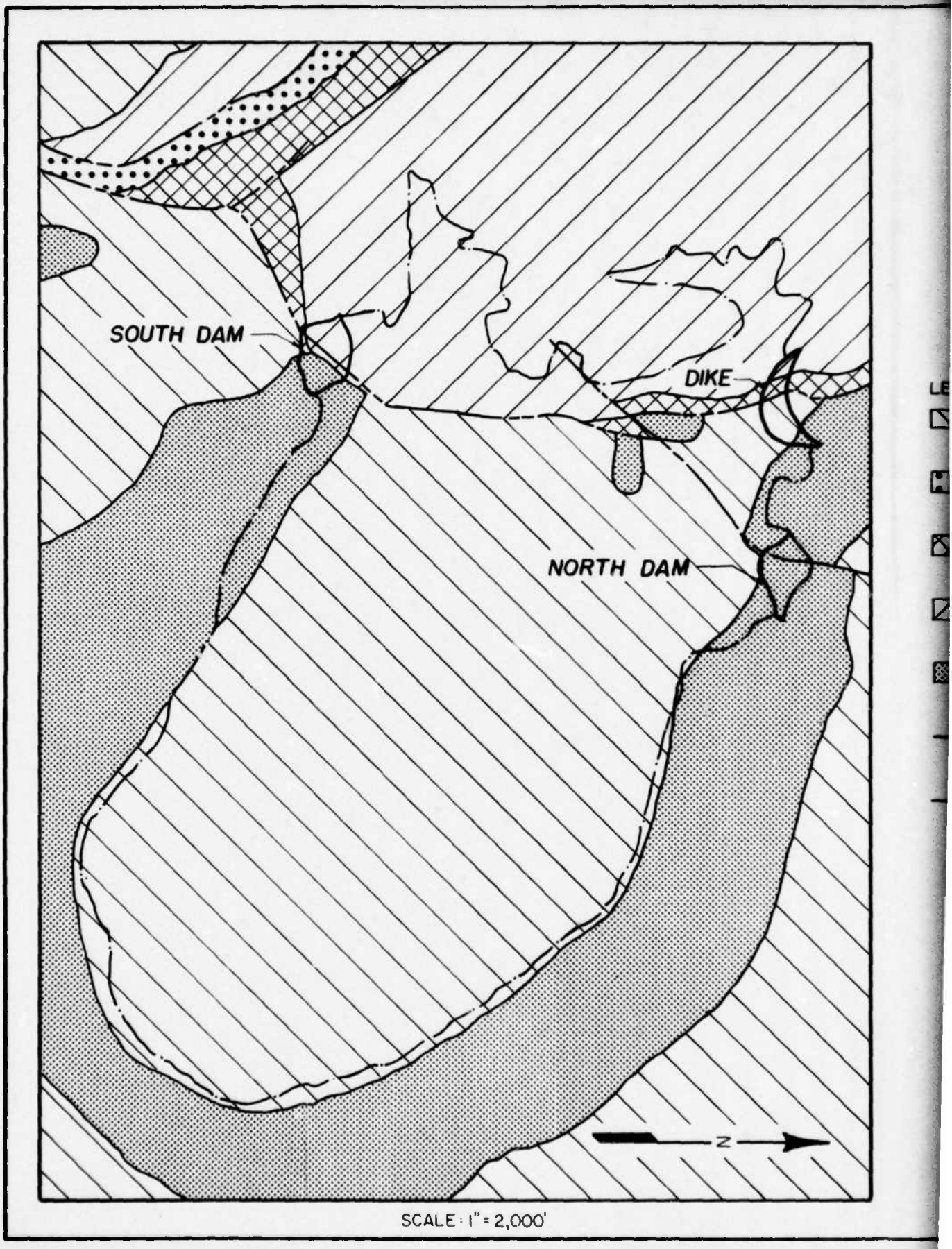


FIGURE 1

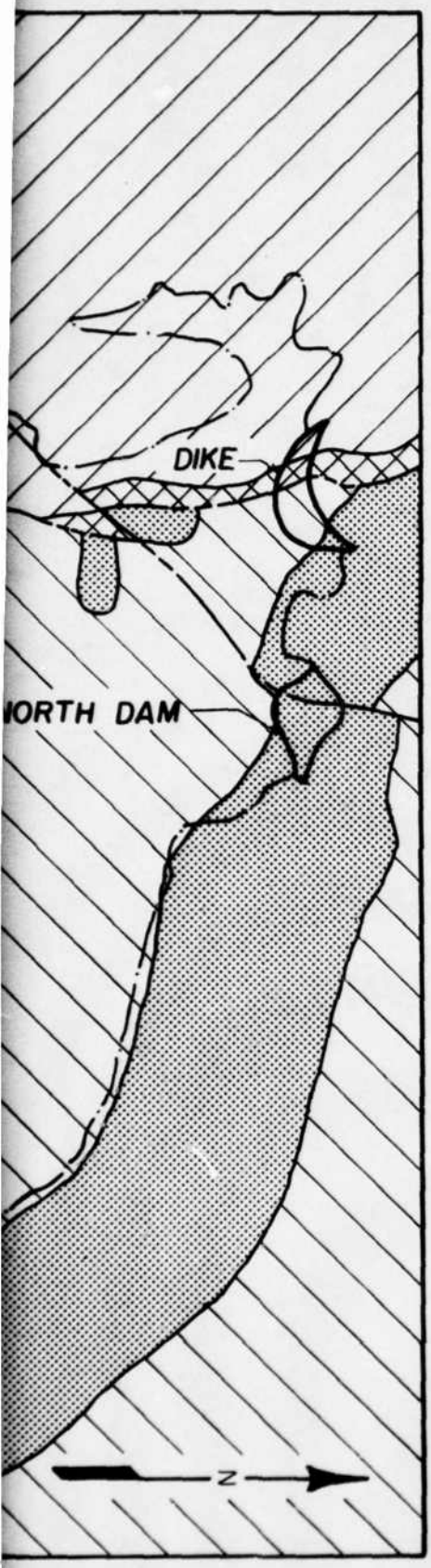
REGIONAL VICINITY MAP

SCALE 1:250,000

N



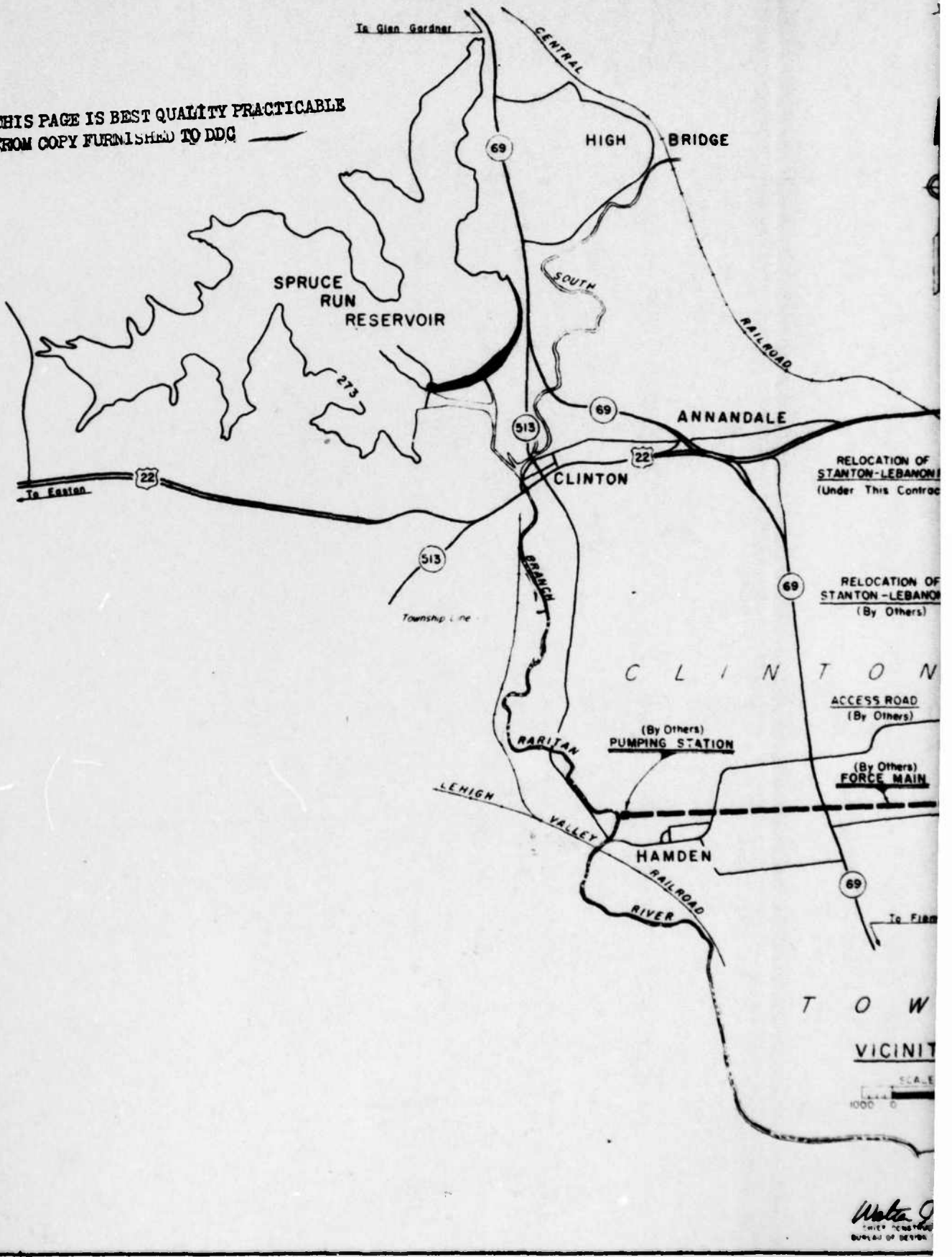
SCALE: 1" = 2,000'

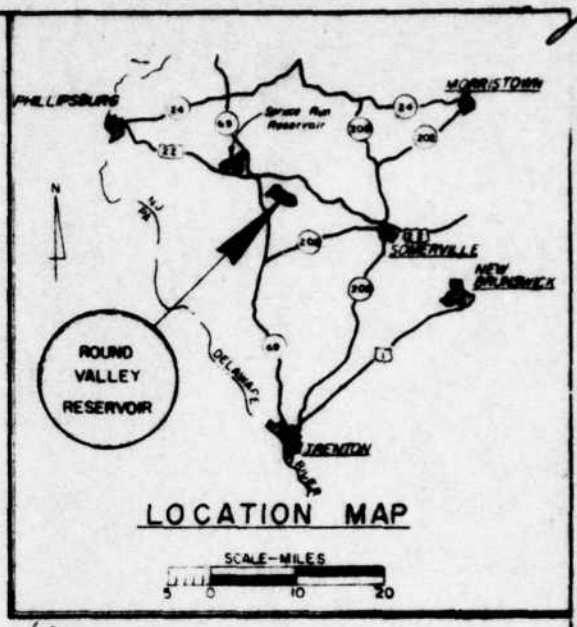


LEGEND:

- BRUNSWICK FORMATION-Red Shale and Sandstone, Triassic
- KITTATINNY LIMESTONE- Cambro-Ordovician
- HARDYSTON QUARTZITE-Cambrian
- GNEISS - Pre-Cambrian
- DIABASE - Triassic
- FAULT
- DESIGN FLOW LINE

FIGURE 2
GEOLOGIC MAP





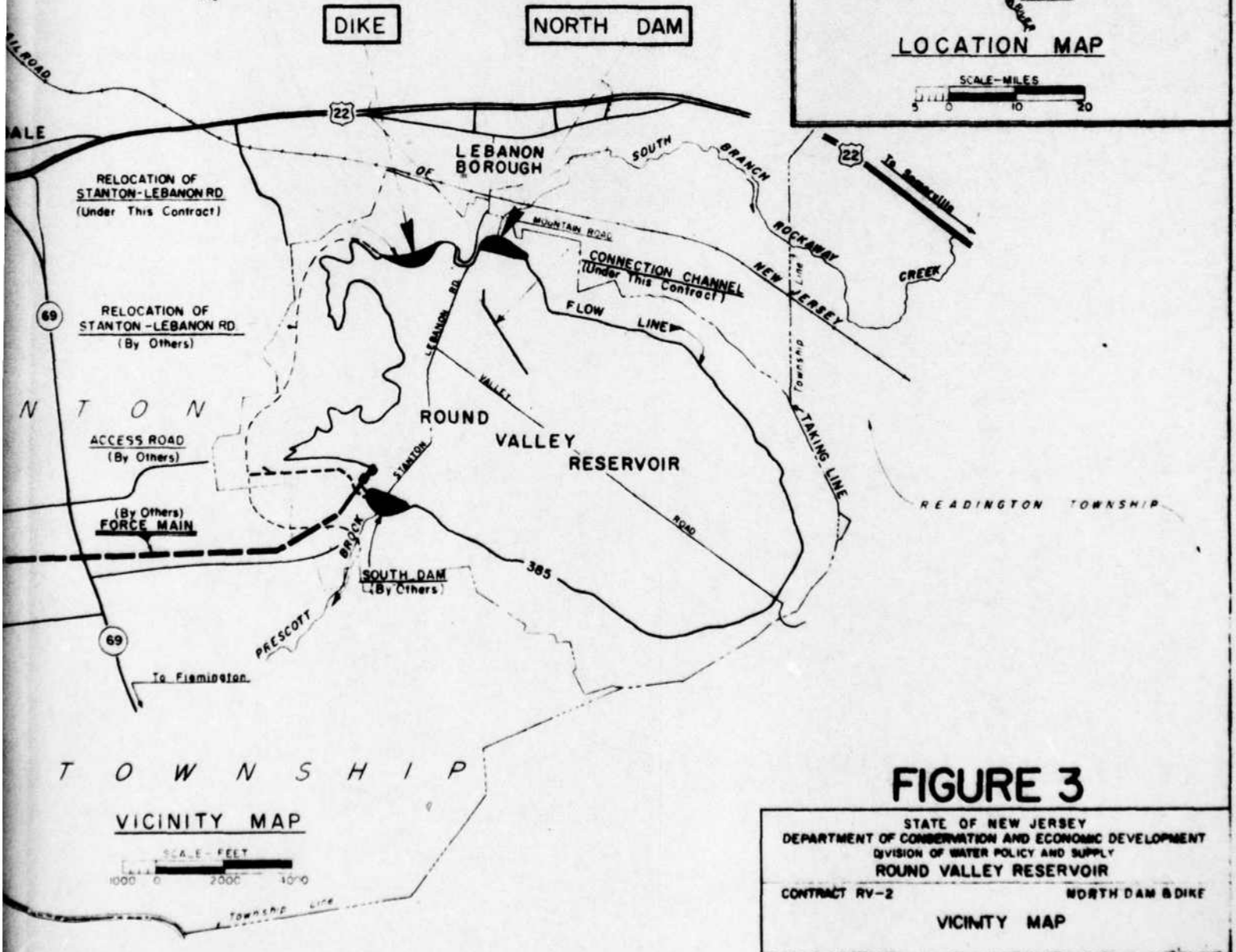


FIGURE 3

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
ROUND VALLEY RESERVOIR

CONTRACT RV-2 — NORTH DAM & DIKE

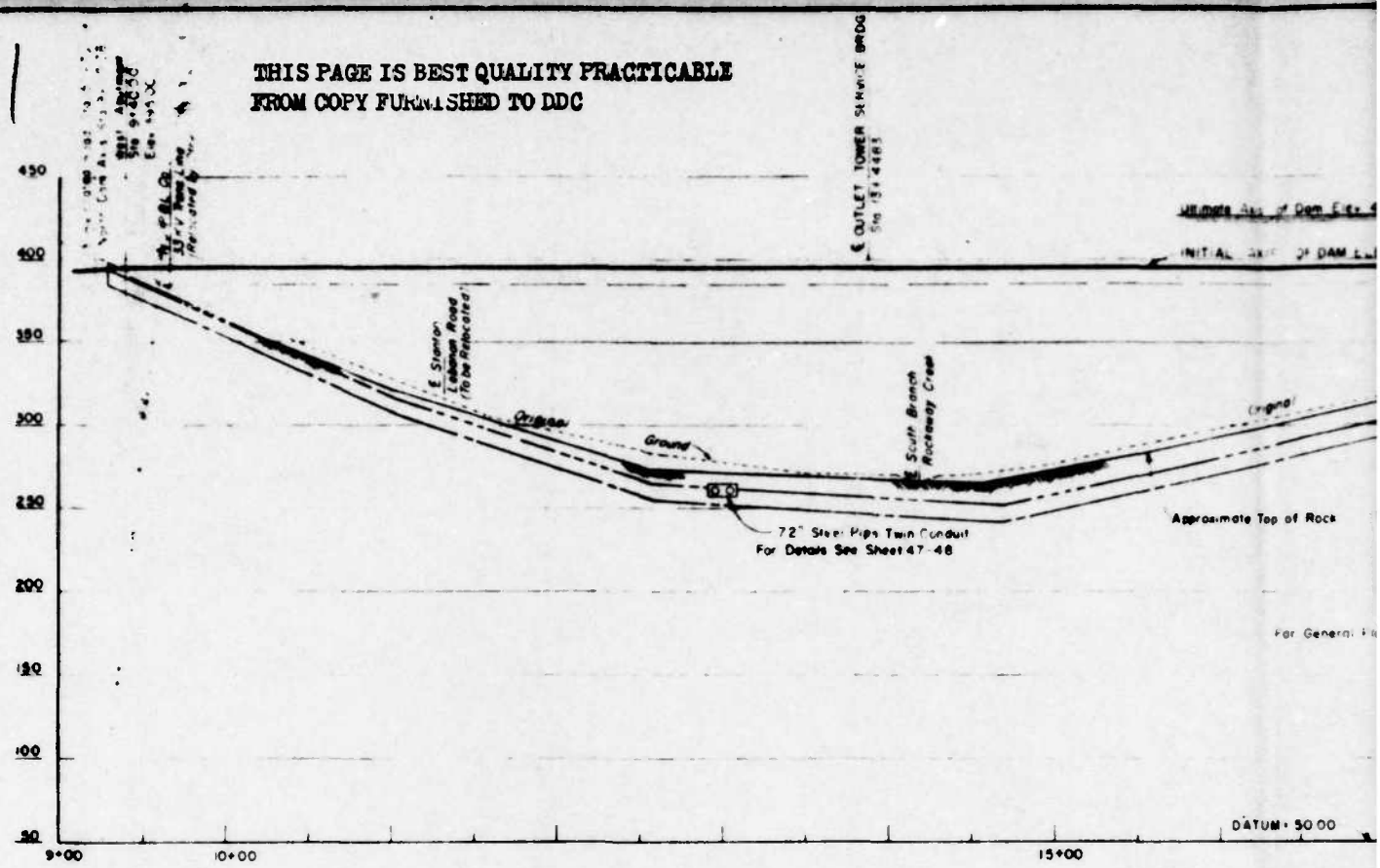
VICINITY MAP

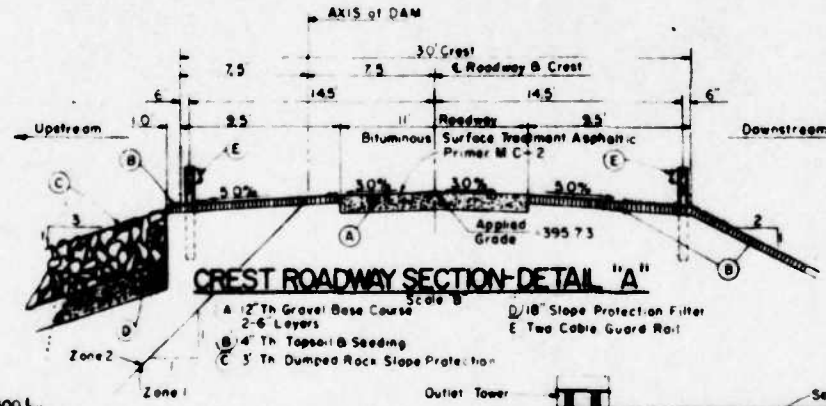
PORTER, URQUHART, McCREARY, & O'BRIEN
CONSULTING ENGINEERS

IN CHARGE C.F. OBSS	SCALE 1" = 2000'	SHEET 3 of 69
DRAWN PBH / TRACED PBH / CHECKED LC	DATE Feb 14, 1964	ACC PUB NO-202

Walter J. Marx
CHIEF CONSTRUCTION ENGINEER
BUREAU OF DESIGN & CONSTRUCTION

PORTER, URQUHART, McCREARY & O'BRIEN

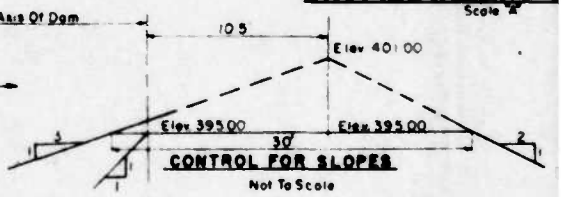


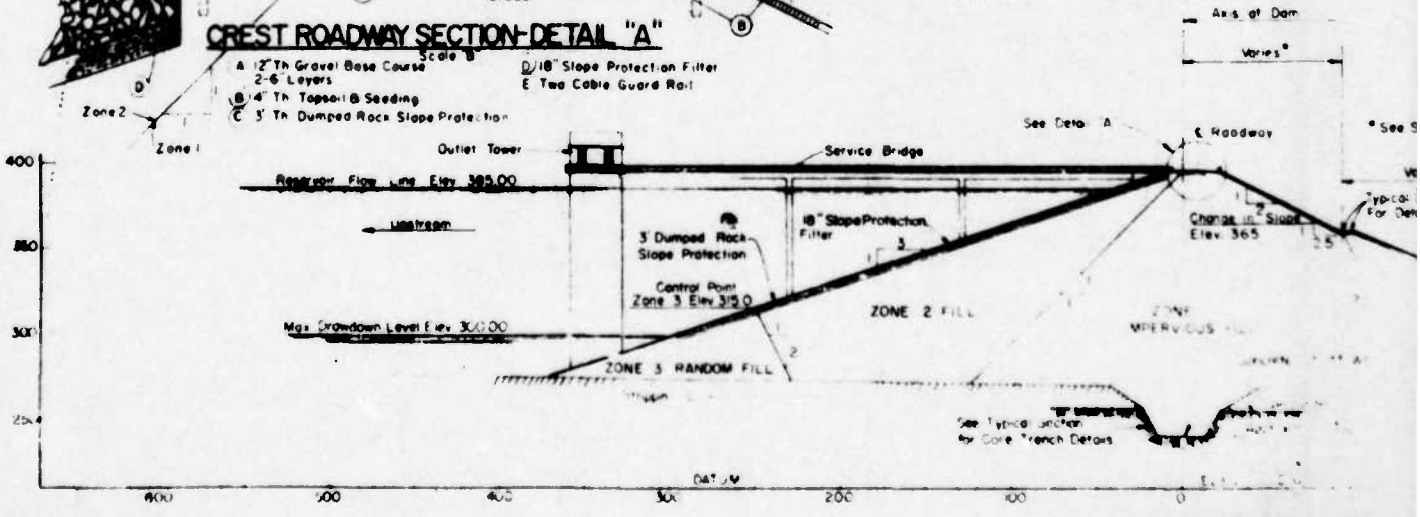


CREST ROADWAY SECTION-DETAIL "A"

Scale 8

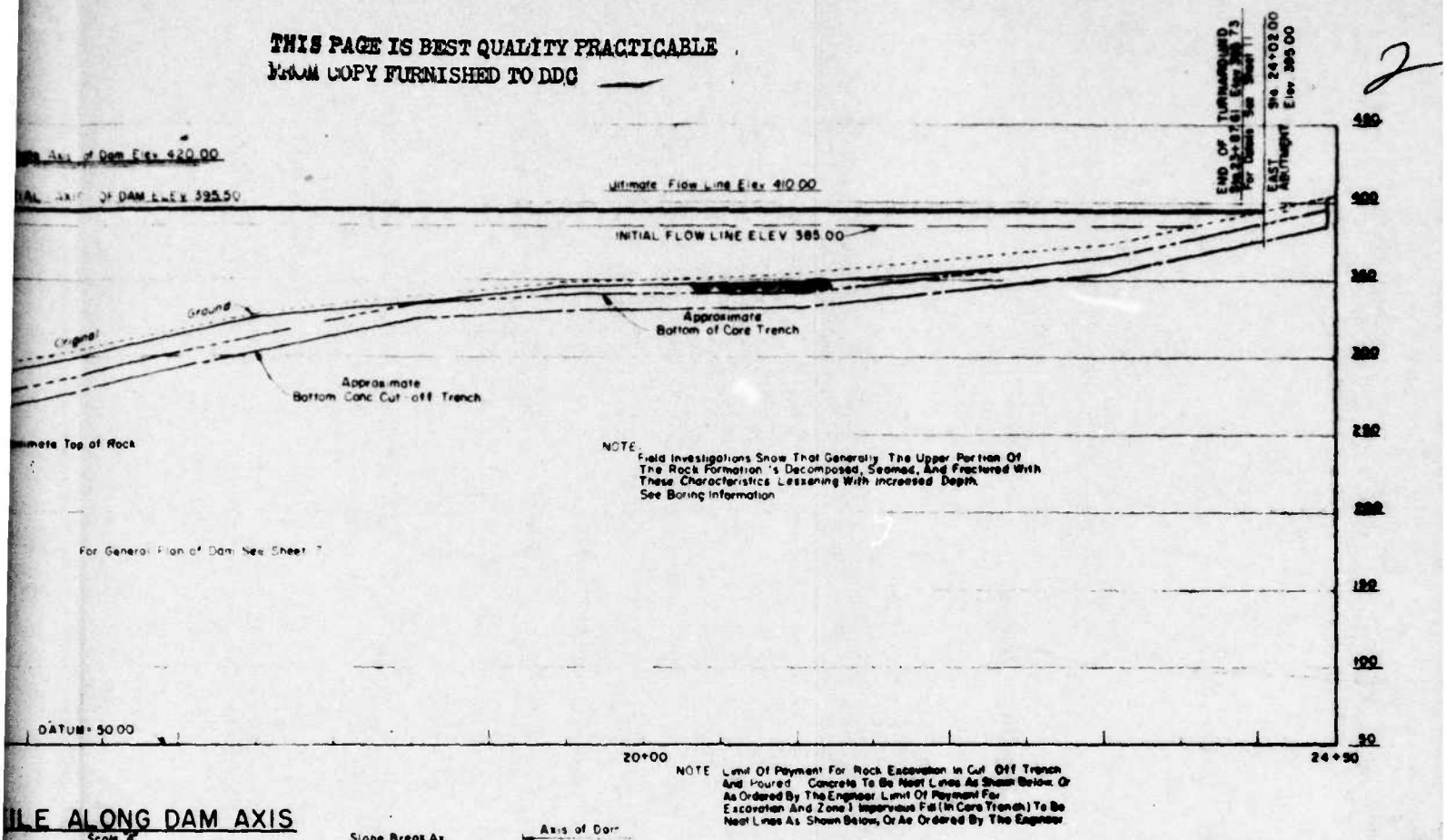
A 12" Th Gravel Base Course 2-6 Layers
B 4" Th Topsoil & Seeding
C 3' Th Dumped Rock Slope Protection
D 18" Slope Protection Filter
E Tee Cable Guard Rail





TYPICAL SECTION

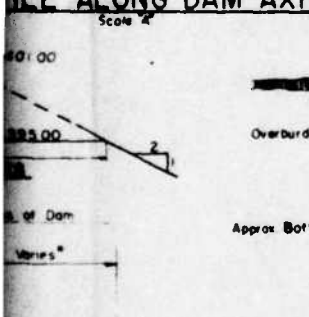
2

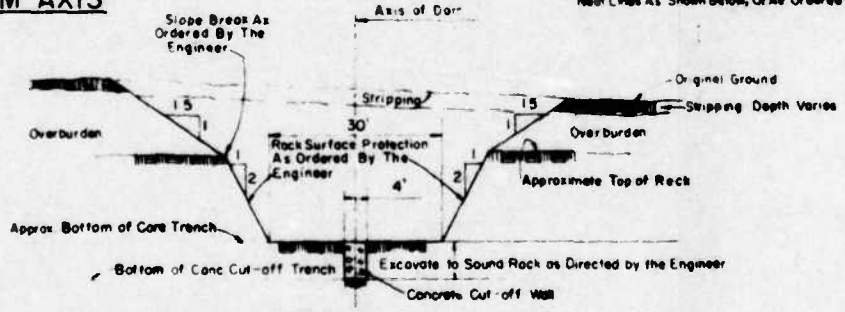


NOTE Limit Of Payment For Rock Excavation In Cut Off Trench And Poured Concrete To Be Neat Lines As Shown Below Or As Ordered By The Engineer Limit Of Payment For Excavation And Zone 1 Impervious Fill (In Core Trench) To Be Neat Lines As Shown Below, Or As Ordered By The Engineer

ILE ALONG DAM AXIS

Scale 4"

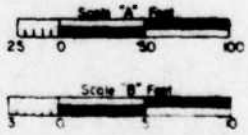




ESTIMATED CORE TRENCH EXCAVATION LIMIT

STATIONS	ESTIMATED DEPTH (After Stripping)
9+40 — 12+50	5'
12+50 — 16+50	16'
16+50 — 17+50	12'
17+50 — 24+00	7'

NOTE Depths of Core Trench Shall Be Increased Or Decreased From Depths Shown As Directed By The Engineer If The Depths Are Increased, Payment Will Be As Specified In Section 331 Of The Specifications



* See Sheet 10

TYPICAL SECTION-CORE TRENCH

Not to Scale

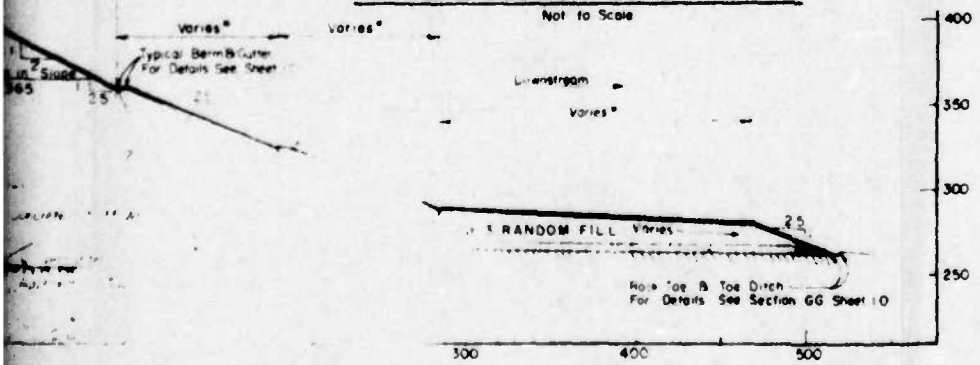


FIGURE 4

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
ROUND VALLEY RESERVOIR

CONTRACT RV-2 NORTH DAM

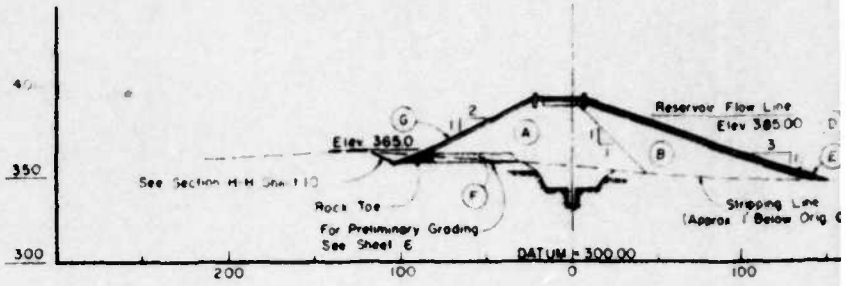
PROFILE & TYPICAL SECTION

PORTER, URQUHART, McCREARY, & O'BRIEN
CONSULTING ENGINEERS NEWARK, N.J.

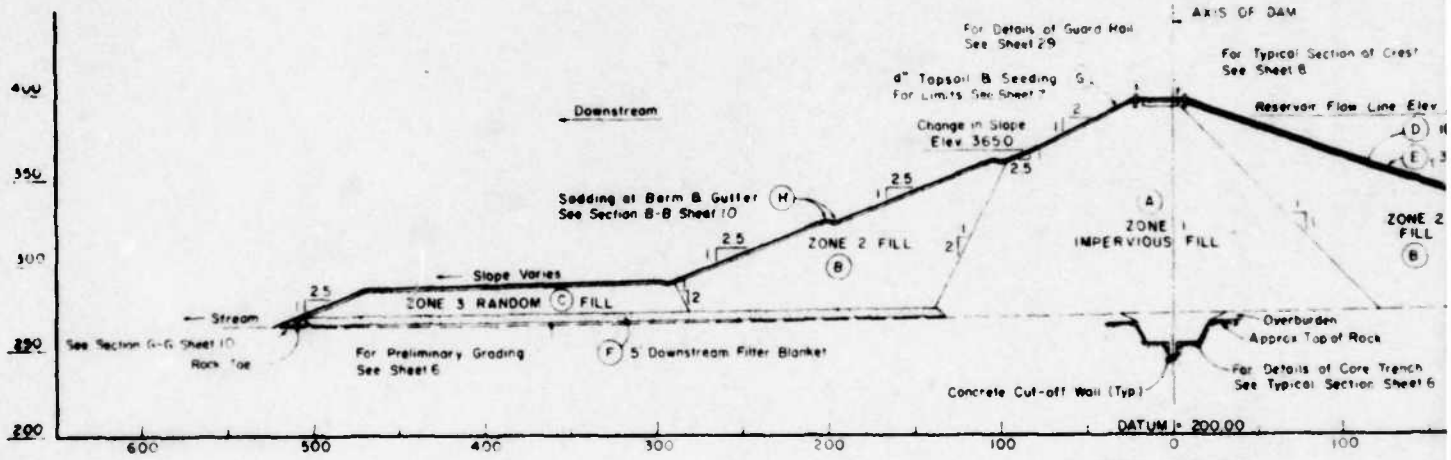
IN CHARGE C.F.G.R.G.			SCALE AS SHOWN	SHEET 8 of 57
DRAWN	TRACED	CHECKED		
S.J.J.	A.W.S.	L.C.	DATE: Feb 14, 1961	ACC P.U.M.O.-20

Walter J. Shea
CHIEF CONSTRUCTION ENGINEER
BUREAU OF DESIGN & CONSTRUCTION

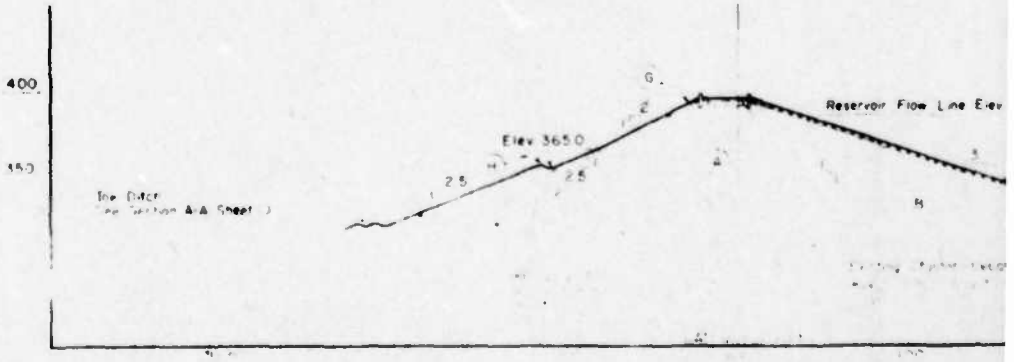
PORTER URQUHART McCREARY & O'BRIEN



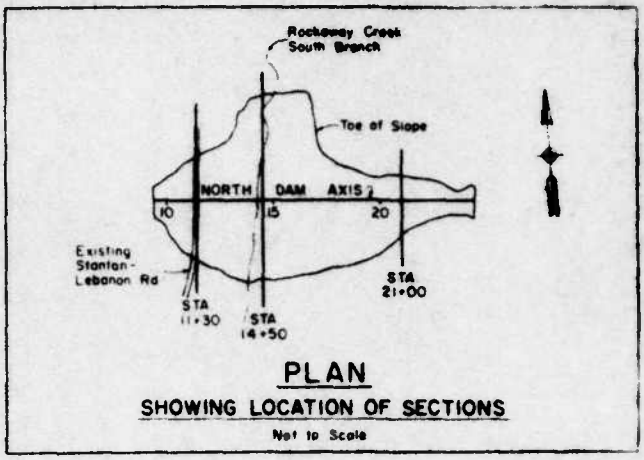
STA. 21+00



STA. 14+50



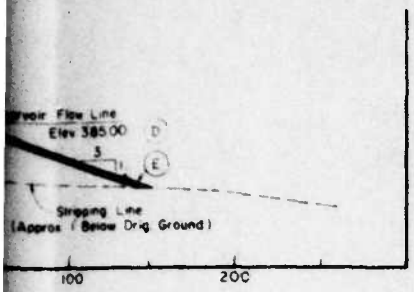
STA 11+30

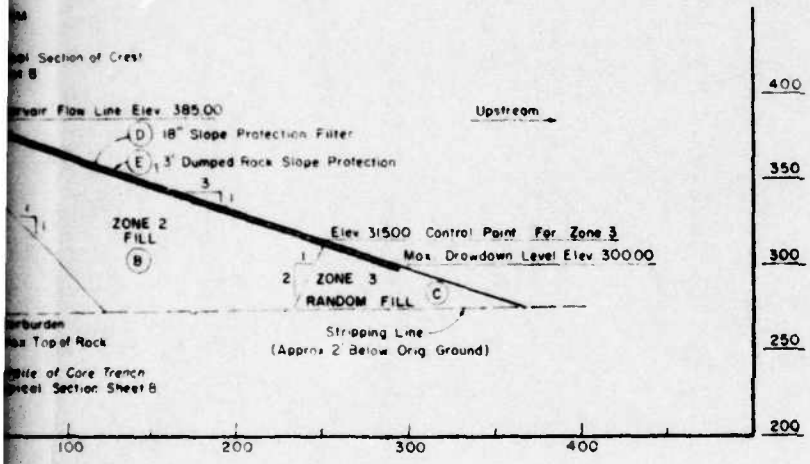


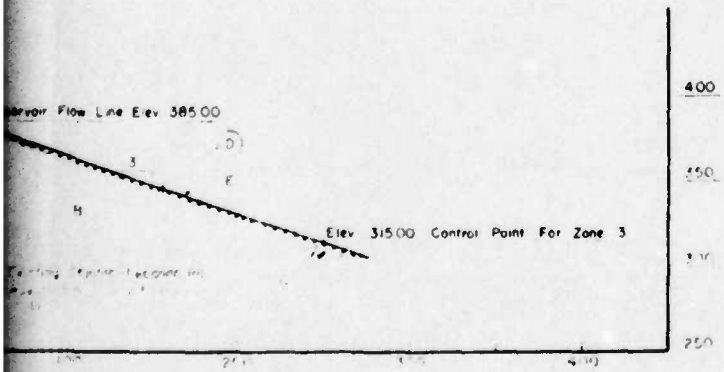
PLAN

SHOWING LOCATION OF SECTIONS

Not to Scale







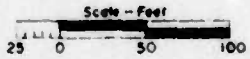


FIGURE 5

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
ROUND VALLEY RESERVOIR

CONTRACT RV-2 — NORTH DAM

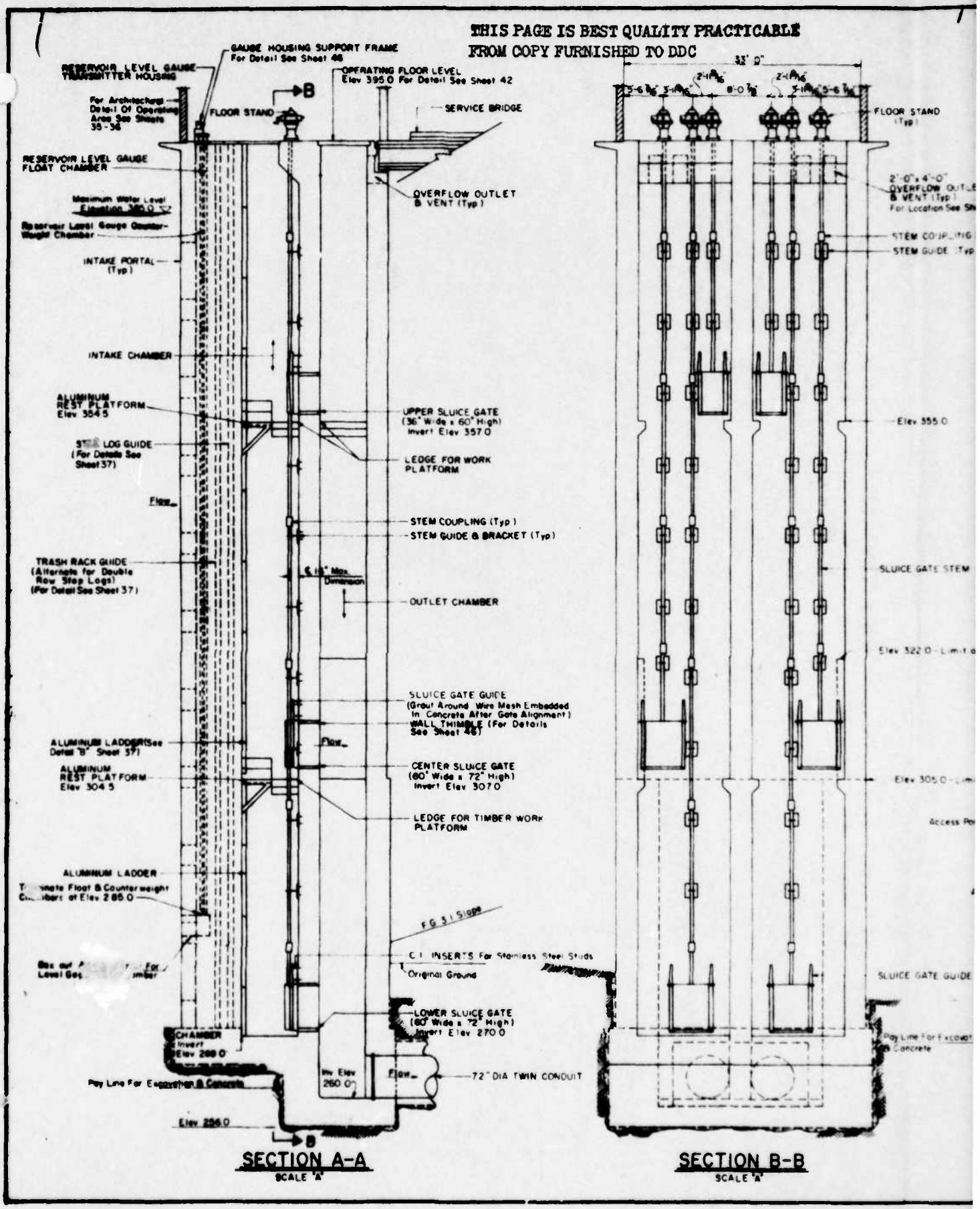
TRANSVERSE SECTIONS FOR EMBANKMENT

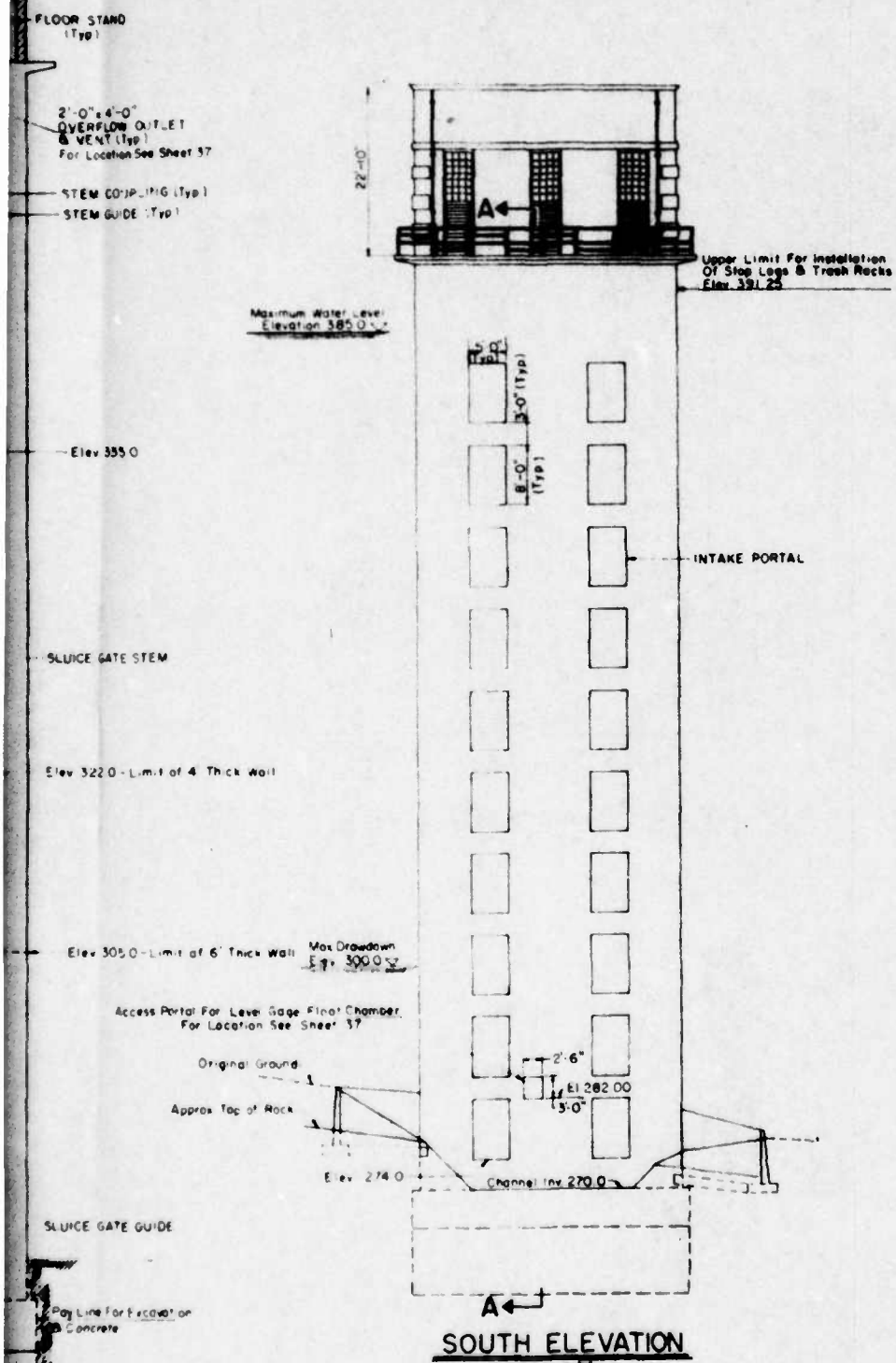
PORTER, URQUHART, McCREARY, & O'BRIEN
CONSULTING ENGINEERS
NEWARK, N.J.

IN CHARGE C. F. GRIGG			SCALE 1" = 50'	SHEET 9 of 87
DESIGNED	TRACED	CHECKED		
A.W.J.	A.W.J.	L.C.	DATE: Feb. 14, 1964	ACC. P.U.M.O-208

Walter C. Gibson
CHIEF CONSTRUCTION ENGINEER
BUREAU OF DESIGN & CONSTRUCTION

PORTER, URQUHART, McCREARY & O'BRIEN





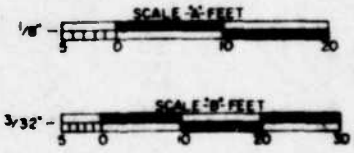


FIGURE 6

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
ROUND VALLEY RESERVOIR

CONTRACT RV-2 NORTH DAM

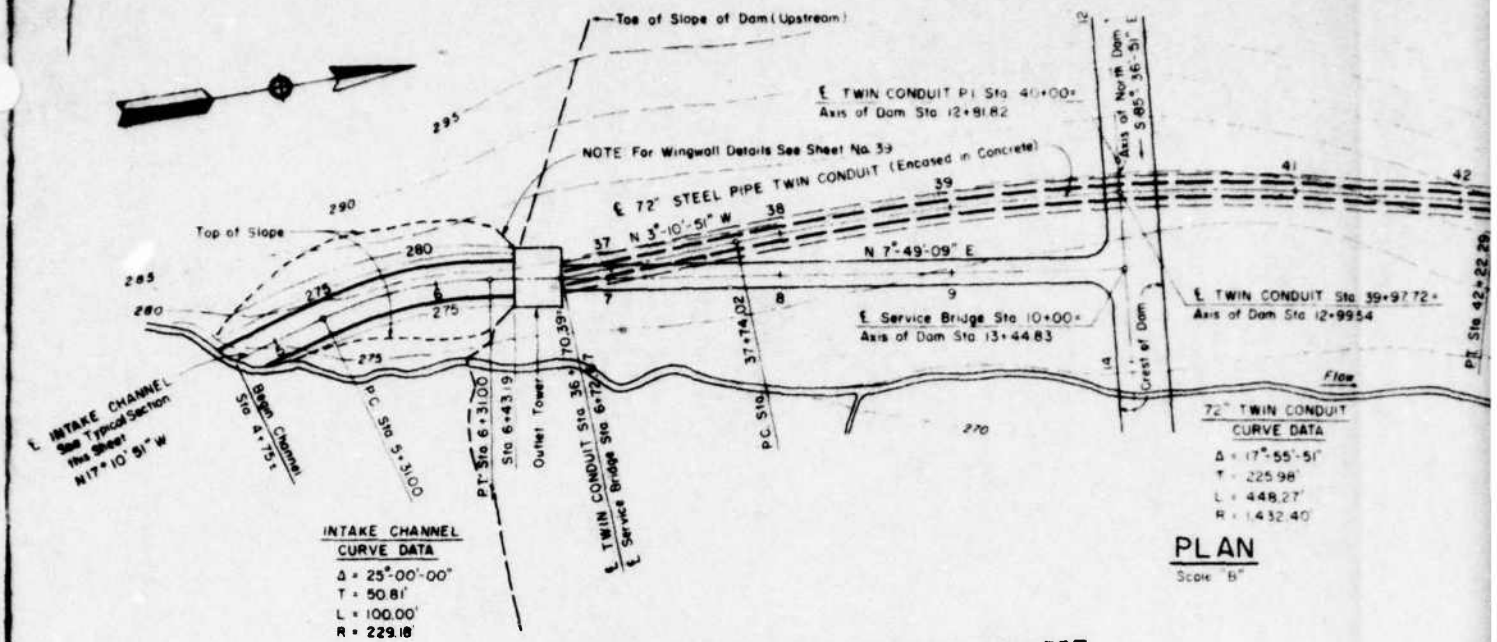
OUTLET TOWER
MECHANICAL SECTIONS & ELEVATION

PORTER, URQUHART, McCREARY, & O'BRIEN
CONSULTING ENGINEERS NEWARK, N.J.

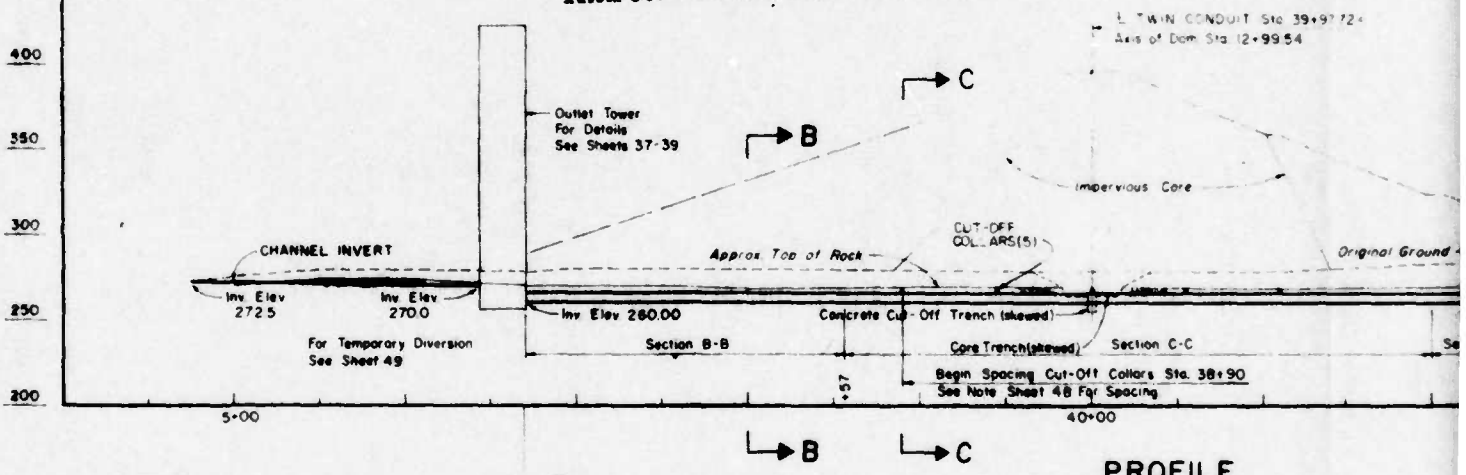
IN CHARGE C.F. GRIGG			SCALE: AS SHOWN	SHEET 41 of 57
DRAWN	TRACED	CHECKED		
H.E.R.	M.D.V.	J.E.C.	DATE: Feb 14, 1961	ACC. PU.M.O.-24

Walter J. Mason
CHIEF CONSTRUCTION ENGINEER
BUREAU OF DESIGN & CONSTRUCTION

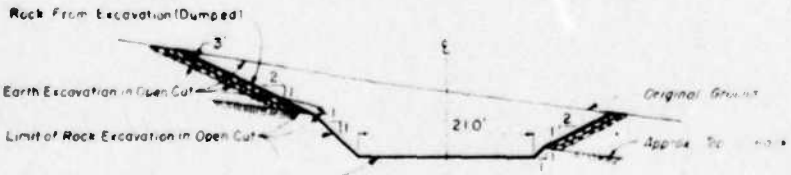
PORTER, URQUHART, McCREARY & O'BRIEN



PLAN
Scale "B"

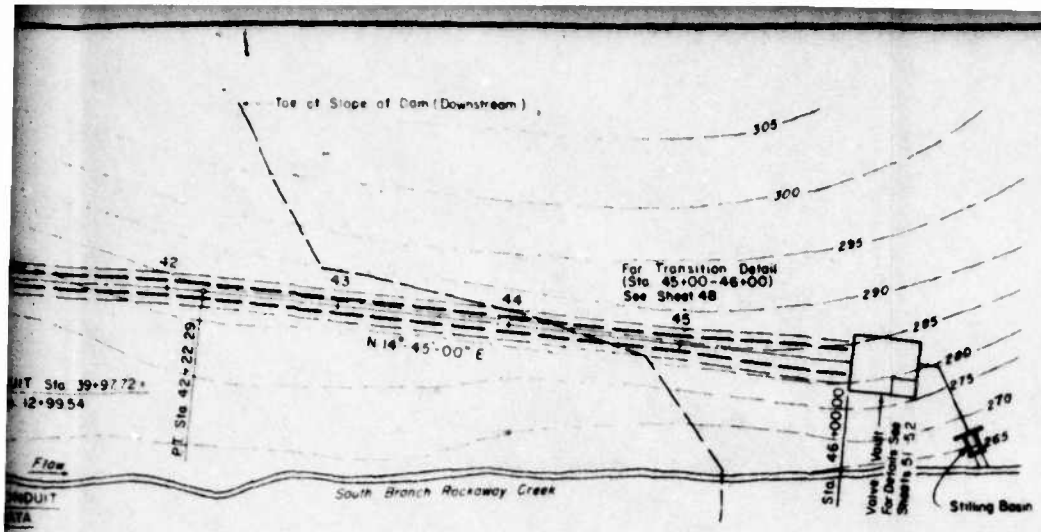


PROFILE
Scale "B"

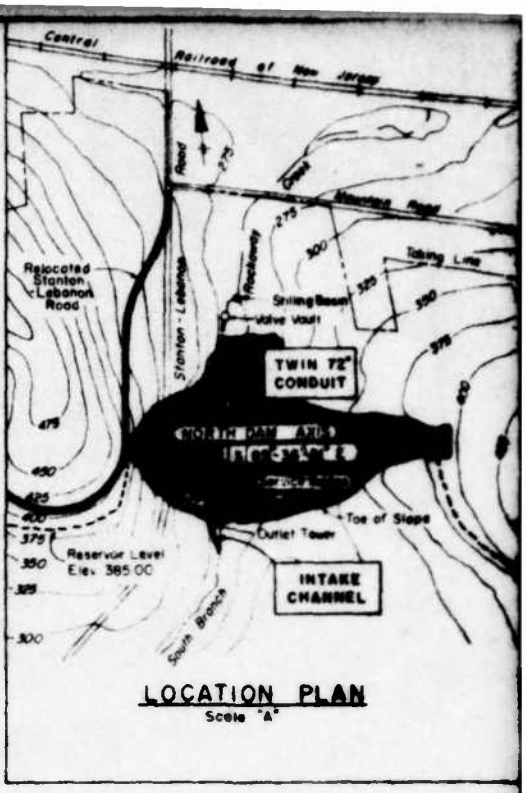


TYPICAL SECTION
INTAKE CHANNEL
Not to scale

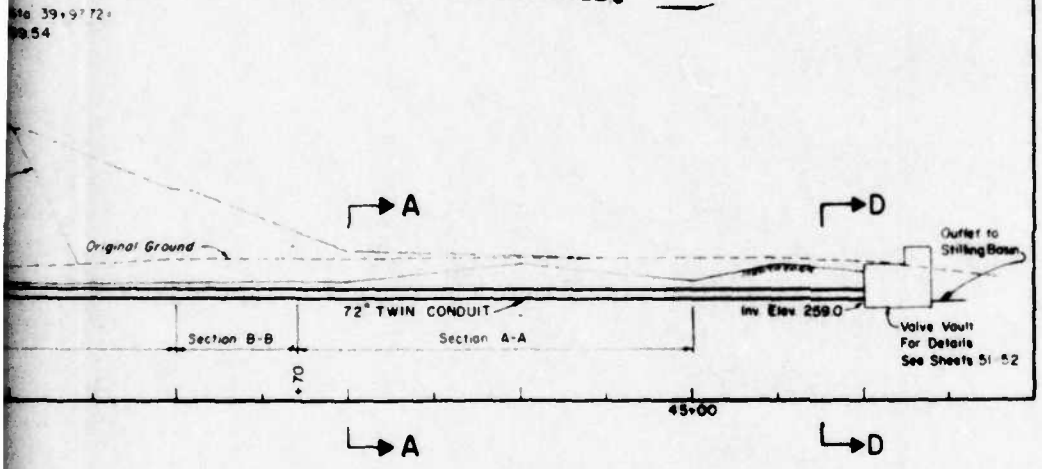
EXCAVATION



NOTE
In Lieu of Constructing the Twin 72" Pipe Line on Curve as Shown, the Contractor May Construct the Line on Tangent With Special Sections Beveled to the Correct Angle at the PI

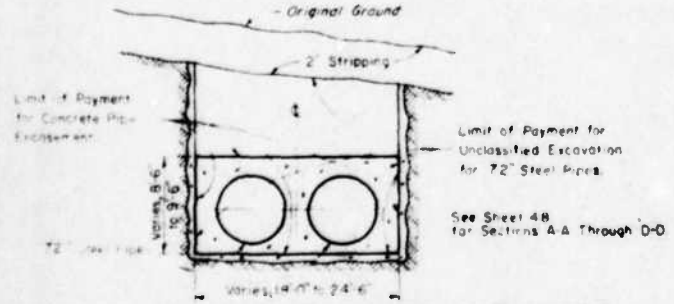


LOCATION PLAN
Scale "A"



NOTES

The Steel Pipe Shall Have a Minimum Thickness of ½" and Be Coated & Lined With Bituminous Materials As Specified
See Sheet 48 for Sections
For Typical Pipe Joints, See Sheet 48
For Details of Stilling Basin See Sheet 50
Should Conditions Require Excavation of the Core Trench Below the Bottom Elevation of the Encasement for the Twin 72" Pipe Lines, This Excavation Shall be Backfilled With Concrete for the Width of the Encasement. Foundation Grouting Shall be Performed Beneath the Concrete Cut Off Wall a Minimum of 15' Either Side of the ℄ of the Twin 72" Pipes Prior to Laying the Pipe Across the Core Trench



EXCAVATION PAYMENT LINES FOR 72" PIPES
Not to Scale

FIGURE 7

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
ROUND VALLEY RESERVOIR

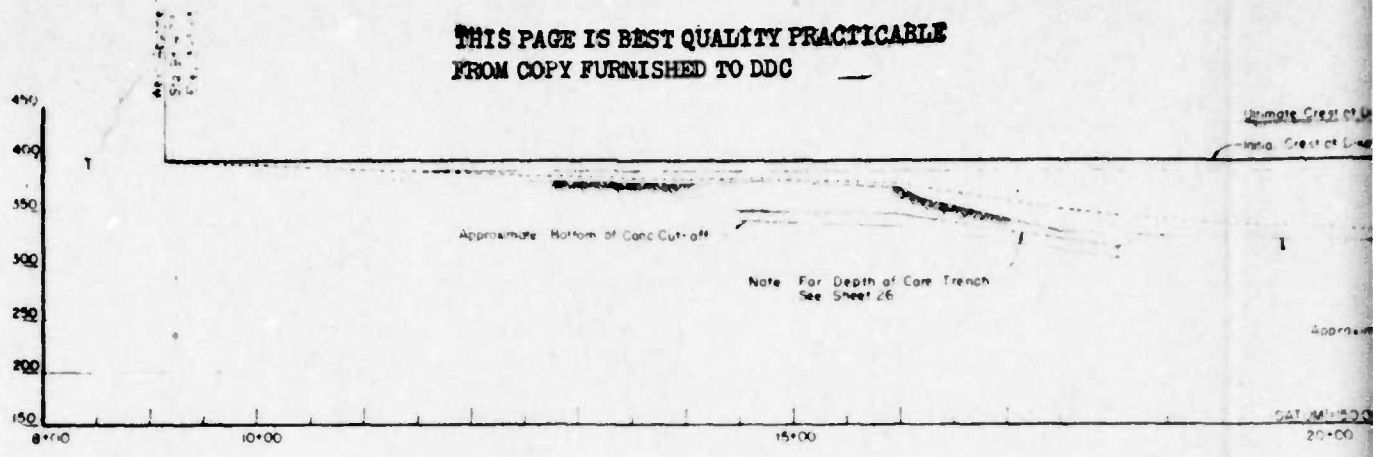
CONTRACT RV-2 NORTH DAM
72" STEEL PIPE TWIN CONDUIT
PLAN & PROFILE

PORTER, URQUHART, McCREARY, & O'BRIEN
CONSULTING ENGINEERS NEWARK, N.J.

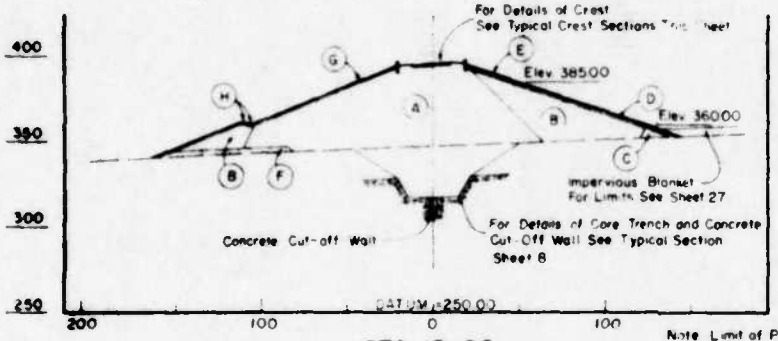
IN CHARGE C.F. GRIGG			SCALE: AS SHOWN	SHEET 47 of 57
DRAWN	TRACED	CHECKED	DATE: Feb 14, 1961	ACC. P.U.M.D.-29
A.W.J.	A.W.J.	L.C.		

Walter J. Shea
CHIEF CONSTRUCTION ENGINEER
BUREAU OF DESIGN & CONSTRUCTION

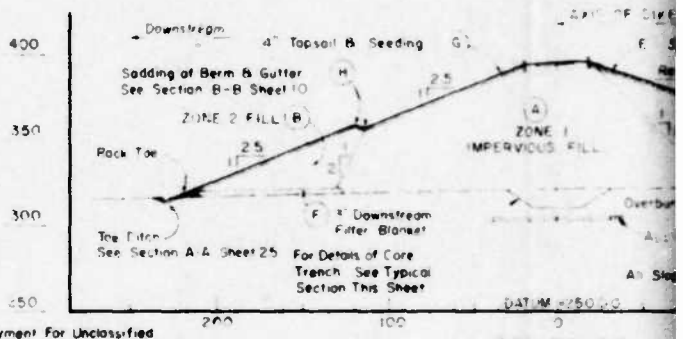
PORTER, URQUHART, McCREARY & O'BRIEN



PROFILE ALONG DIK
Scale "



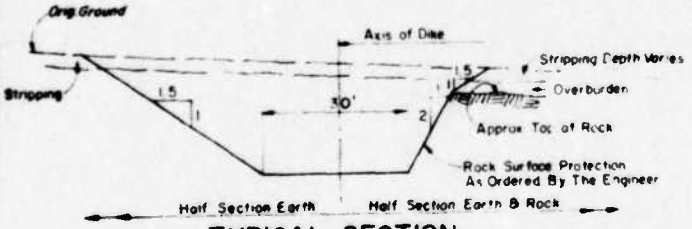
STA. 18+00



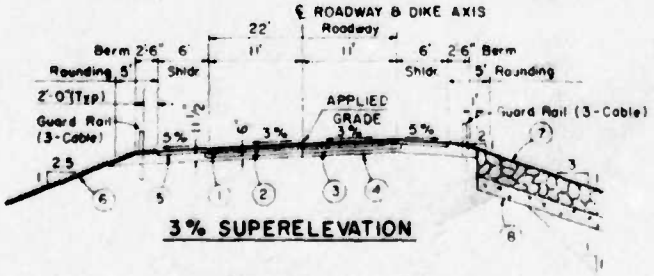
STA. 24+00

Note Limit of Payment For Unclassified Excavation and Zone 1 Impervious Fill (In Core Trench) to be Neat Lines As Shown Below or as Ordered By the Engineer

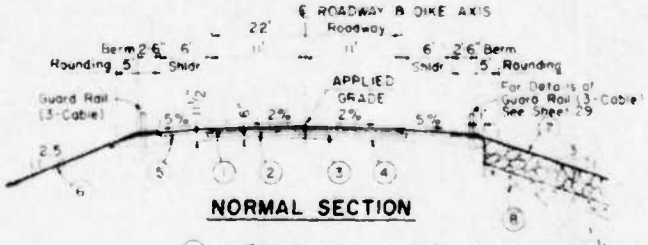
TRANSVERSE SECTIONS FO
Scale "B"



TYPICAL SECTION
CORE TRENCH WITHOUT CONCRETE CUT OFF WALL



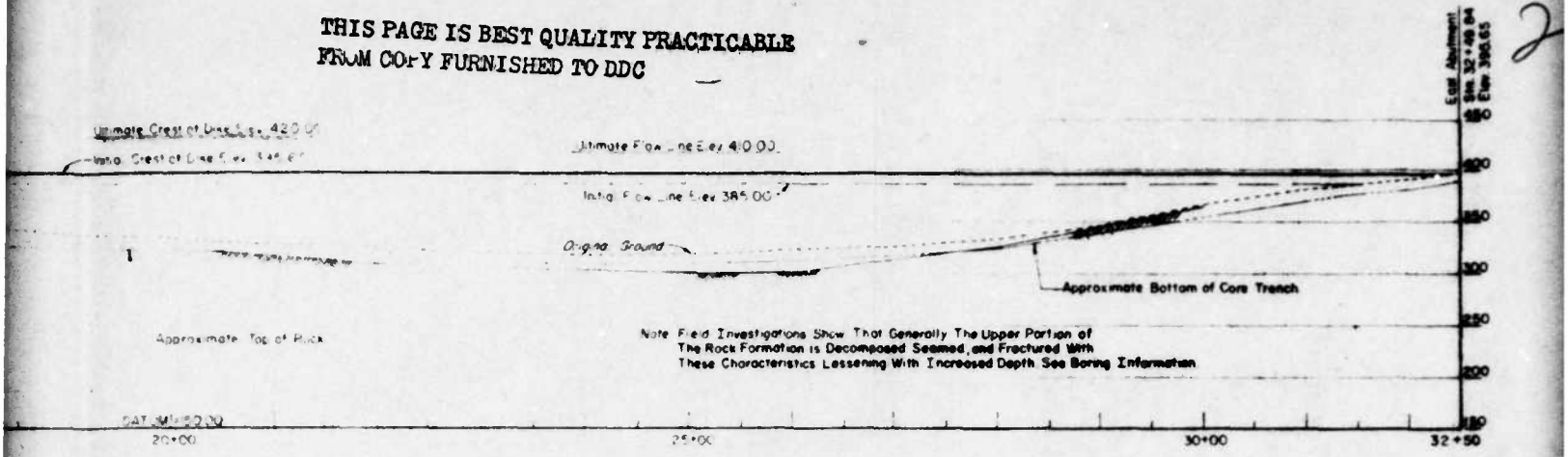
3% SUPERELEVATION



NORMAL SECTION

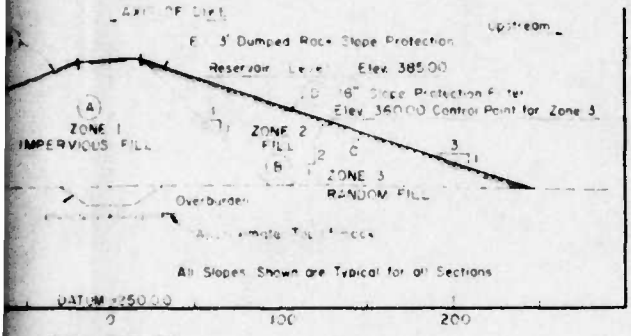
1. 1 1/2" Th. Pavement Type FA-BC-1
2. 3" Th. Penetration Macadam Intermediate Course
3. 4" Th. Macadam Base Course
4. Gravel Base Course
5. 3" Penetration Macadam Shoulder with Surf Treat
6. 4" Th. Topsoil & Seeding
7. 3' Th. Dumped Rock Slope Protection
8. 18" Slope Protection Filter

TYPICAL CREST SECTIONS
Scale "C"

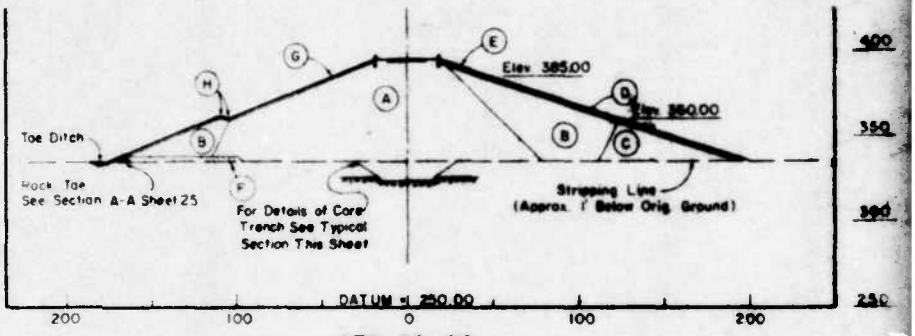


FILE ALONG DIKE AXIS

Scale "A"



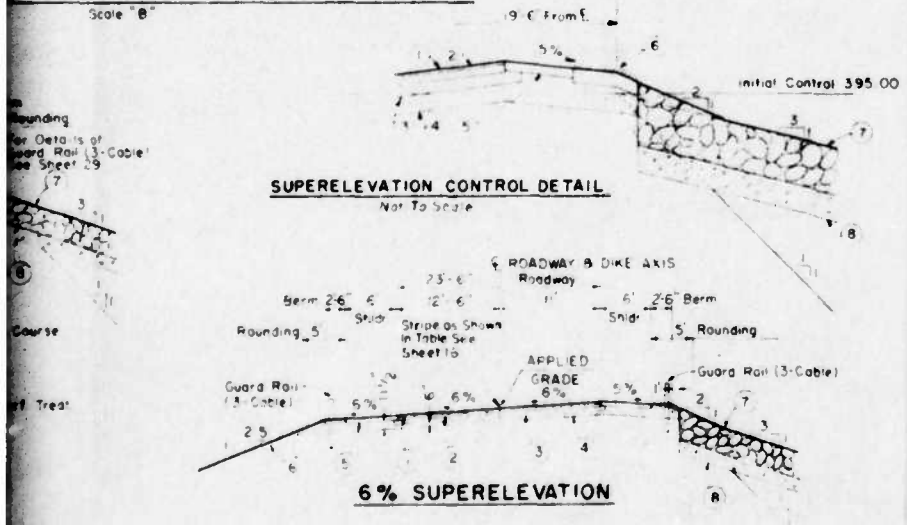
STA. 24+00



STA. 28+00

SECTIONS FOR EMBANKMENT

Scale "B"



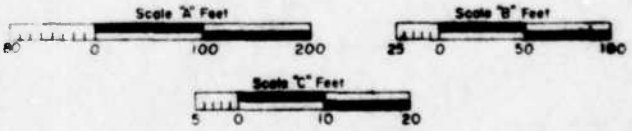


FIGURE 8

STATE OF NEW JERSEY
DEPARTMENT OF CONSERVATION AND ECONOMIC DEVELOPMENT
DIVISION OF WATER POLICY AND SUPPLY
ROUND VALLEY RESERVOIR

CONTRACT RV-2 — DIKE

PROFILE & SECTIONS

PORTER, URQUHART, McCREARY, & O'BRIEN
CONSULTING ENGINEERS — NEWARK, N.J.

IN CHARGE C F BRIGG			SCALE: AS SHOWN	SHEET 24 of 57
DRAWN	TRACED	CHECKED	DATE: Feb 14 1961	ACC. PU.M.O. 22
A.W.J.	A.W.J.	L.C.		

Walter J. Shea
CHIEF CONSTRUCTION ENGINEER
BUREAU OF DESIGN & CONSTRUCTION

PORTER URQUHART McCREARY & O'BRIEN

APPENDIX

FIELD INSPECTION

REPORT

Check List
Visual Inspection
Phase 1

Name Dam Round Valley North Dam & Dike County Hunterdon State New Jersey Coordinators Mr. Larry Woscyna Mr. John Garafolo New Jersey DEP

Date(s) Inspection 4/19/78 4/24/78 Weather Rainy Clear Temperature 45° 55°

Pool Elevation at Time of Inspection 381 M.S.L. Tailwater at Time of Inspection --- M.S.L.

Inspection Personnel:

Mr. John J. Williams
Mr. David Campbell
Mr. George Elias
Mr. Albert Depman
Mr. Anthony Geiss

Mr. David Campbell Recorder

Accompanied by:

Mr. Albert DePhilippe, Chief of Foundation and Materials Branch, US Army Corps of Engineers, Philadelphia Dist.
Mr. A. Gregory Chase, Supervising Engineer, New Jersey Dept. of Environmental Protection, Division of Water Resources
Mr. Walter O'Rourke, Supervisor of Reservoirs, New Jersey Dept. of Environmental Protection, Division of Water Resources
Mr. John Garafolo, Civil Engineer, New Jersey Department of Environmental Protection
Mr. Larry Woscyna, Civil Engineer, New Jersey Department of Environmental Protection

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	NORTH DAM Small cracks were observed on the top of the North Dam. The cracks were parallel to the crest of dam, and extended from the outlet tower service bridge to about 200 feet from east abutment. DIKE None noted.	The cracks should be monitored to detect any movement.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None Noted.	None.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	NORTH DAM Some minor erosion of the reservoir shoreline to the east of the east abutment. DIKE A slight settlement area was observed at the center of the embankment just above the toe.	None.
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	No problems noted.	None.
RIPRAP FAILURES	NORTH DAM AND DIKE Gradation of the riprap is poor. Large angular stone (2 to 4 feet in diameter) is mixed with small stone and gravel (6 inches or less), with very little intermediate sized stone. The stone sizes are segregated in some areas.	The rip rap should be graded more evenly, and sizes added as necessary.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems noted.	None.
ANY NOTICEABLE SEEPAGE	NORTH DAM Seepage from several springs along the east abutment was observed. Discharge from the springs was directed to the drainage gutter. Standing water was noted in the middle berm, about 200 feet from the west abutment, with a saturated area extending about 30 feet up the slope.	The seepage and saturated areas should be monitored regularly.
	DIKE The central 300 to 400 feet of the embankment below the berm was observed to have a significant growth of reeds and several marshy areas. The ground below the embankment was marshy and overgrown with reeds. Three drop inlets were observed; one at each abutment along the toe, and one at the center of the embankment berm. Each of the drop inlets directs runoff and seepage water to a common basin at the center of the embankment toe. The common basin discharges into the marshy area below the toe. Water was observed entering each of the inlets.	The seepage and saturated areas should be monitored regularly.

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
STAFF GAGE OR RECORDER	The North Dam outlet tower is equipped with a Stevens paper chart water level recorder. The paper chart was not operating at the time of inspection.	None.
DRAINS	According to the design drawings, the dam and dike are equipped with blanket drains. The drains are beneath the embankment, and could not be observed. However, seepage water noted at the toe of both embankments was clear.	None.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	N/A	None
INTAKE STRUCTURE	The outlet tower is in excellent condition. A very small amount of seepage was observed, along with some insignificant honeycombing of the concrete at the base of the tower.	None
OUTLET STRUCTURE	Valve vault for the twin 72 inch diameter pipes is located about 1,000 feet downstream of the crest of the North Dam. The building and appurtenances appear to be in excellent condition.	None
OUTLET CHANNEL	Outlet conduits are twin 72 inch diameter steel pipes encased in concrete. The pipes are in excellent condition, with the exception of some minor rusting of the pipe joints that is insignificant.	None
EMERGENCY GATE	None	None

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	The slopes are moderate and do not appear to affect the safety of the dam.	None
SEDIMENTATION	The reservoir is pumped storage, so sedimentation would not appear to be a problem.	None

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	The Tributary to South Branch Rockaway Creek originates from seepage of the filter drains within the North Dam embankment, and discharge is supplemented when necessary to maintain a minimum flow of .17 million gallons per day.	None
SLOPES	Downstream of the North Dam, the stream enters a wide valley of rolling terrain containing the South Branch Rockaway Creek.	None
APPROXIMATE NO. OF HOMES AND POPULATION	The town of Lebanon, New Jersey is located within a mile of the North Dam. The population is approximately 1,000 (250 homes).	None

ITEM	REMARKS
MONITORING SYSTEMS	Personnel from the New Jersey Department of Environmental Protection, Division of Water Resources, operate and monitor operation of the reservoir.
MODIFICATIONS	Stone rubble drainage gutters across the berms were replaced with concrete gutters in 1970.
HIGH POOL RECORDS	Maximum pool of record was 385.0 in August of 1975.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None noted.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	None noted.
MAINTENANCE OPERATION RECORDS	None noted.

ITEM	REMARKS
DESIGN REPORTS	See next page.
GEOLOGY REPORTS	See next page.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	See next page.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	See next page.
POST-CONSTRUCTION SURVEYS OF DAM	Unknown.
BORROW SOURCES.	Impervious material from the valley floor, and semipervious material from the valley rim.

May 4, 1978

Mr. Gregory Chase
Supervising Engineer
Bureau of Water Facility Operations
P.O. Box 5196
Clinton, NJ 08809

Dear Mr. Chase:

Thank you for your cooperation in the Phase I Inspection of the Round Valley Reservoir structures. Below is a list of the documents on loan from your office for this investigation:

By Porter, Urquhart, McCreary & O'Brien:

1) Report on Experimental Grouting, March, 1960.
2) Round Valley Reservoir, Design Analysis for South Dam, December, 1959.
3) Round Valley Reservoir, Design Analysis for Dike, December, 1959.
4) Round Valley Reservoir, Design Analysis for North Dam, December, 1959.
5) Outlet Tower, Design Calculations, December, 1959.
6) Intake Tower, Design Calculations, June, 1960.
7) Engineering Geology of the Round Valley Reservoir, Books 1 & 2, September, 1960.
8) Report of Laboratory Test Results, December, 1959.

By Whitman, Requardt & Associates:

Appendices to the Engineering Report, Spruce Run - Round Valley Reservoir Project, September, 1958.

By Fred L. Fox:

Final Report, Soils Operations & Control, January, 1963.

Sincerely,

O'BRIEN & GERE ENGINEERS, INC.
JUSTIN & COURTNEY DIVISION

David B. Campbell
Design Engineer

DBC/pc

PHOTOGRAPHS

OUTLET TOWER AND UPSTREAM FACE OF NORTH DAM

POOR GRADATION OF RIP RAP ON NORTH DAM EMBANKMENT

HYDROLOGIC AND HYDRAULIC CALCULATIONS

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET NO. 1 OF

NAME OF CLIENT CORPS OF ENGINEERS

DATE 3/13/78

COMP. BY DBC

PROJECT ROUND VALLEY

CHECKED BY LW

PMF HYDROLOGY

DRAINAGE AREA = 5.4 SQUARE MILES

RESERVOIR SURFACE AREA = 3.6 SQUARE MILES

6-HOUR 10 SQUARE MILE PMP = 26"
ZONE = 6

THE DRAINAGE AREA IS LESS THAN 10 SQUARE MILES, SO NO REDUCTION REFLECTING BASIN SIZE IS INCLUDED.

A REDUCTION OF 20% IS INCLUDED TO ACCOUNT FOR IMPERFECT FIT OF BASIN AND STORM ISOHYETALS.

∴ 6-HOUR PMP = 20.8"

48 HOUR PMP = 1.26 × 20.8 = 26"

SINCE 2/3 OF THE BASIN IS RESERVOIR SURFACE, AND NO OUTFLOW IS CONSIDERED, 48 HOUR PMF IS APPLIED TO THE RESERVOIR WITH LOSSES CONSIDERED ONLY FOR THE OVERBANK AREA.

RAINFALL ON THE RESERVOIR	26"	
RAINFALL ON THE OVERBANKS	26"	
LOSSES (CN=60)	6.5"	
RUNOFF FROM OVERBANKS		19.5"

JUSTIN & COURTNEY, INC.
Division of O'Brien & Gere Engineers, Inc.
PHILADELPHIA, PA

SHEET No. 2 OF ____
DATE 3/13/78
COMP. BY DBC
CHECKED BY LW

NAME OF CLIENT CORPS OF ENGINEERS
PROJECT ROUND VALLEY

TOTAL RISE IN RESERVOIR ELEVATION

$$\frac{3.6 \text{ s.m.} \times 26'' + 1.8 \text{ s.m.} \times 19.5''}{36 \text{ s.m.}} = 36''$$

$\simeq$ 3 FEET

FREEBOARD CALCULATION

FROM DESIGN OF SMALL DAMS, P. 273.

FETCH $\simeq$ 1.5 MILES

WIND VELOCITY 50 MPH

$\therefore$ WAVE HEIGHT = 2.9 FEET

WAVE: $\frac{1}{2}$ RUNUP

$1.5 \times 2.9' = 4.4'$ ABOVE THE MAXIMUM WATER SURFACE, OR 7.4' ABOVE THE MAXIMUM OPERATING POOL.

THE EMBANKMENT IS PROVIDED WITH 10.5' OF FREEBOARD ABOVE THE MAXIMUM OPERATING POOL, SO THE FREEBOARD ALLOWANCE IS ADEQUATE.


EN
DAT
FILM

VISUAL EXAMINATION OF
JUNCTION OF EMBANKMENT A ABUTMENT, SPILLWAY AND
ANY NOTICEABLE SEEPAGE

VISUAL EXAMINATIO

STAFF GAGE OR REC

DRAINS

VISUAL EXAMINATION OF

CRACKING AND SPALLING
CONCRETE SURFACES IN
OUTLET CONDUIT

INTAKE STRUCTURE

OUTLET STRUCTURE

OUTLET CHANNEL

EMERGENCY GATE

VISUAL EXAMINATI

SLOPES

SEDIMENTATION

VISUAL EXAMI

CONDITION
(OBSTRUCTI
DEBRIS, E

SLOPES

APPROXIMATE
OF HOMES AN
POPULATION

TOOL, SO THE FREEBOARD ALLOWANCE IS ADEQUATE.